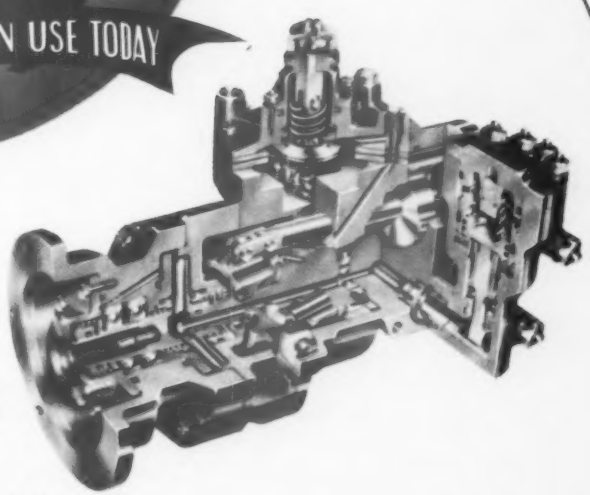
THE AEROPLANE and ASTRONAUTICS

JUNE 24, 1960

EVERY FRIDAY
ONE SHILLING
AND SIXPENCE



Lucas Hydraulic motors and pumps...

From the experience gained over twenty years in the manufacture of 100,000 fuel systems comes the Lucas range of hydraulic motors and pumps for aircraft and missiles.

ENGLAND · CANADA & AUSTRALIA

LUCAS

Bridge across the Bosphorus

Istanbul is a divided city, split into two by the unpredictable waters of the Bosphorus. On the western shore lies Yesilkoy airport, important fuelling point for international airlines. On the other side, at Beykoz, is the Shell installation from which aviation fuel has constantly to be fed across the Straits by barge.

Just an ordinary ferrying operation? Far from it. The Bosphorus is no ordinary waterway. Into it flows escape water from the Black Sea, swollen by torrents from the mighty rivers Danube, Don, Dniester and Dnieper. It is seldom calm and in places the current reaches 6 knots. Beneath steep, craggy banks the water swirls, at times being whipped into fury by the "Lodos" wind which troubles even the largest ocean-going vessels and makes tying up to the jetties with a cargo of inflammable spirit a precarious job.

There are other hazards. Dense fog in spring and autumn can bring shipping to a halt, and in winter icefloes can make navigation a nightmare. The Bosphorus, too, is a vital waterway and is often thronged with traffic — 18,000-ton tankers; heavy men-of-war; the ubiquitous caiques and fishing boats. Through them all, as normal routine, the Shell barge threads its way to and fro every day, carrying the supplies which are life-blood to the international airline operators.

An ordinary ferrying operation? The Shell crews make it appear so. Airfields need regular supplies of aviation products and, come what may, Shell will get them there somehow.

SHELL

you can be sure of Shell

Second class postage paid at New York, N.Y.

Gnome engined Whirlwind

Gnome

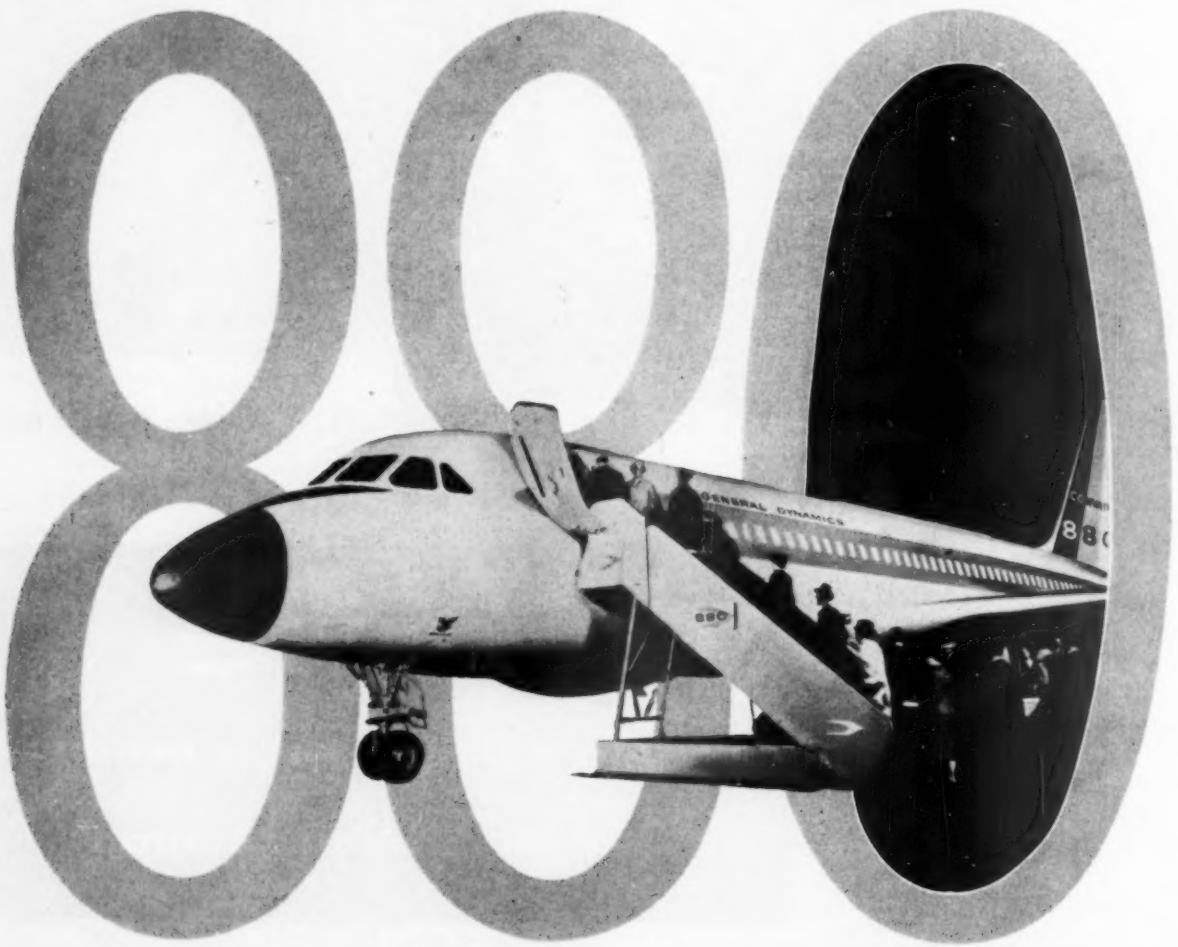
ordered into quantity production

by the Ministry of Aviation

THE DE HAVILLAND ENGINE COMPANY LIMITED

LEAVESDEN HERTFORDSHIRE

Of all the jets now in service, only the CONVAIR 880 brings you "years ahead" speed and luxury today! It is the world's newest – the world's fastest jet passenger plane.



CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION

First to offer Convair 880 or 600 service will be TWA, DELTA, REAL-AEROVIAS (Brazil), SWISSAIR, S.A.S., AMERICAN, C.A.T. (Formosa), AVENSA (Venezuela), J.A.L. (Japan

Rotax were first with the Brushless Alternator

Now—

another first!

THE SOLID ROTOR ALTERNATOR

* Eliminating brushes and rotating windings.
* Particularly suitable for high temperature and high speeds. Ideal for high mach number aircraft.
* Also supplied as a brushless d.c. generator without rotating winding. (A lighter machine than any other brushless d.c. generator.)
* Ask for the new illustrated leaflet.

Your engineers are invited to see tests. Write or telephone: Sales Director

ROTAX

FULL COVERAGE BY ROTAX SERVICE IN MOST PARTS OF THE WORLD

ROTAX LTD., Willesden Junction, London, N.W.10. (Elgar 7777)
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., Melbourne and Sydney, Australia.
LUCAS-ROTAX LTD., Toronto, Montreal and Vancouver, Canada.

Give your pipework

GENFLEXIBILITY

with the new

GENFLEX EXPANSION JOINTS

Genflex bellows expansion joints are the easiest and most economical method of absorbing thermal movement in pipework systems. Made by Vokes Genspring, the largest manufacturers of compensated pipe hangers in Europe, they combine the advantages of absorbing vibration and movement in all planes with extreme simplicity of installation and elimination of maintenance.

Standard Genflex joints are formed from specially treated stainless steel with a longitudinal butt weld and are available in sizes from 3" bore. Special test equipment ensures rigid adherence to manufacturing tolerances and standards. On completion the units are subjected to stringent tests to determine fatigue limits.

Genflex expansion joints can be used in shaft seals and packless glands, expansion pockets, packless valves and mechanisms, flexible joints and in many other applications. Joints can be manufactured for special requirements and in a wide variety of metals and alloys. A staff of specialist engineers is always available to help with the correct siting of bellows, anchors, pipe guides, etc.

Please write for the comprehensive Genflex catalogue.

Vokes Genspring SUSPENSION SYSTEMS

VOKES GENSPRING LIMITED

HENLEY PARK · GUILDFORD · SURREY

Telephone: Guildford 62861 Telegrams & Cables: Vokesacess, Guildford, Telex

Telex: 13-535 Vokesacess, Guildford

A member of the VOKES Group

VG 50/D

"The Oil Engine" World Directory of Manufacturers

Published in association with

"THE OIL ENGINE AND GAS TURBINE"

This Directory lists all oil engine manufacturers throughout the World, with their addresses, and contains brief details of the complete range of prime movers built by each manufacturer.

For each range of engines manufactured the Directory indicates, at a glance, the classification, number of cylinders, highest catalogued working speed, and rated horse-power of the smallest and largest engines in the range.

Specifications are given in a convenient and readily-comparable form, and there is a three-language glossary of the technical terms used.

Containing details of the full engine range of no less than 333 manufacturers in 27 different countries, this unique Directory will prove a constant and valuable source of reference for all users of diesel engines, installation engineers, consultants, and suppliers requiring concise and accurate information as to the ranges offered by manufacturers throughout the world.

INDIA

AUTOMOBILE PRODUCTS OF INDIA LTD.

Agra Road, Bhandup, Bombay 40

(*Meadows licence*)

Industrial (vertical)
Max. speed 2,000 r.p.m. .. Cyls. 4 .. From 36 to 70 b.h.p.

Railway Traction
Max. speed 2,400 r.p.m. .. Cyls. 4 .. From 42 to 90 b.h.p.

Road Transport
Max. speed 2,500 r.p.m. .. Cyls. 4 .. From 47 to 110 b.h.p.

Marine Propulsion
Max. speed 2,000 r.p.m. .. Cyls. 4 .. From 36 to 72 b.h.p.

Marine Auxiliary
Max. speed 2,000 r.p.m. .. Cyls. 4 .. From 36 to 72 b.h.p.

(*Above*): **A specimen entry from the India Section of the World Directory**

Size 7¼ in. × 4⅞ in. 128 Pages. Laminated Card Covers.

Price 7s. 6d. net.

From Booksellers or 7s. 11d. by post from the Publishers

TEMPLE PRESS BOOKS

Bowling Green Lane, London, E.C.1

ALL WE CAN OFFER THE AIR CARGO INDUSTRY IS A PRACTICAL WAY TO MAKE MONEY!

CANADAIR CAN PROVE TO YOU THAT:

YOUR piston powered passenger carrying aircraft now rendered obsolete by new equipment, and being considered for use in cargo operations, or already actually converted can be completely removed from fleet inventory and written down to zero book value in three years;

ONE THIRD the number of Canadair Forty Fours will carry out your cargo requirements at such a profit that they will absorb all expenses incurred in the retirement transaction, plus any earnings your piston engine aircraft would have realized during these three years;

AFTER THESE THREE YEARS, the Forty Four operating profit curve will climb steeply. The difference in profit potential for the following years is substantial.

Any consideration of a specific example requires certain assumptions regarding scheduling, future rates, and load factors, but, under a representative set of conditions our analysis indicates:—that a fleet of 25 piston powered aircraft currently being converted into cargo carriers, could be replaced and retired by a fleet of 8 Forty Fours. The above assumptions and statements are based on the unlikely premise that cargo rates will remain at present levels. If they are reduced, as seems inevitable, the situation will favor the Forty Four even more strongly.

THE FORTY FOUR. The Canadair Forty Four, with its combination of low direct operating costs, high block speeds and large payload capacity, is the world's most economical cargo aircraft. Delivery schedules can be arranged to introduce the Forty Four into airline service fourteen months from contract agreement.

CANADAIR LIMITED, MONTREAL, CANADIAN SUBSIDIARY OF **GENERAL DYNAMICS**

2 good reasons for ZWICKY leadership

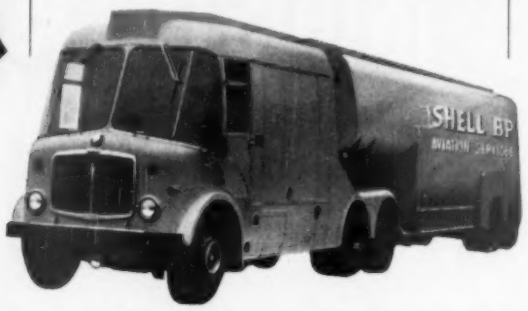
Whatever the type of Aerodrome Ground Equipment called for, ZWICKY is the name to remember, if efficient performance, easy control and economical operation are deciding factors.

"TAGUS" AVIATION HYDRANT DISPENSER

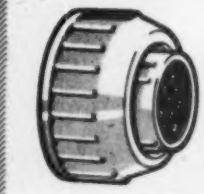
Mounted on Bedford CAZ 10/15 cwt. chassis equipped with 2 delivery circuits to pressure refuel underwing at either high or medium flow rates. Capacity 650 g.p.m. This unit has been designed to meet the requirements of the large Jet Engine Airliners now coming into service throughout the world, i.e.: BOEING 707, D.C.8, COMET, etc.

"SEVERN" 10,000 gal. SUPER REFUELLER

This is an articulated vehicle capable of refuelling at 750 g.p.m. and is equipped with two hydraulic rewind hose reels. A unique feature of this vehicle is the very high weight of product to unladen weight ratio. The actual figure 2.221/1, comparing favourably with other refuellers generally 1/1 or less.



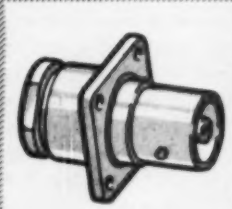
ZWICKY LTD · SLOUGH · BUCKS · Telephone: SLOUGH 21201-5 · Grams: ZWIKLIM, SLOUGH

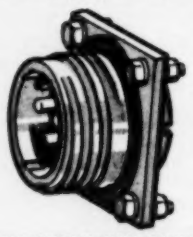


MANUFACTURERS OF

M4 ALUMINIUM and BRASS

PLUGS and SOCKETS





C & BNC RANGE OF CO-AXIAL CONNECTORS

Sole licencees in the U.K. for

"DEUTSCH" MINIATURE CONNECTORS

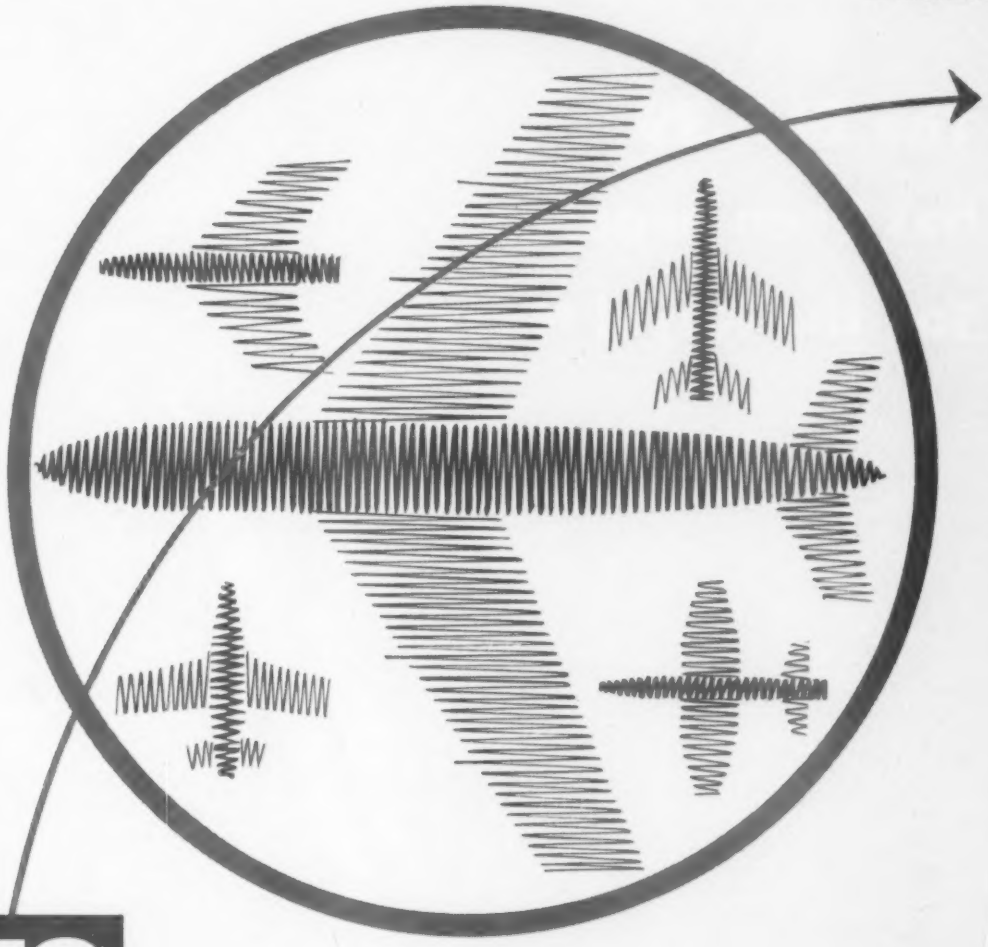
S&B

THE AIRCRAFT AND ELECTRICAL DIVISION OF

SMART & BROWN (Machine Tools) LTD.

25 MANCHESTER SQUARE · LONDON · W.1. *Telephone WELBECK 7941*

Member of the GAS PURIFICATION AND CHEMICAL GROUP OF COMPANIES



STC

radio interference suppressors for high temperature operation

A range of STC Suppressors employing metallised Melinex dielectrics, capable of operation at 125° C and 150° C, to suit the following aircraft applications:-

- ENGINE ELECTRICAL EQUIPMENT
- MAIN POWER GENERATING SYSTEMS
- SHORT TERM RATED MOTORS
- POWER SYSTEMS CONTROL EQUIPMENT

Among the aircraft for which STC Suppressors are specified are:-

COMET IV
BRITANNIA
VISCOUNT
HUNTER
192 HELICOPTER
VANGUARD
CANBERRA
TWIN PIONEER
P.1.
WESSEX HELICOPTER

RADIO INTERFERENCE MEASUREMENT SERVICE

The STC Radio Interference Measurement Service Department is approved by the Ministry of Aviation and the Air Registration Board for type testing of electrical equipment for Radio Interference and also for the design and development of suppressors and suppressor network to the requirements of B.S.G. 100 and E.L. 1716, Section J.

Write for details of STC Interference Suppressors to:-

STC COMPONENTS GROUP

60/5MC

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

CAPACITOR DIVISION: BRIXHAM ROAD · PAIGNTON · DEVON

The NA.39 has been ordered for the Royal Navy

BLACKBURN AIRCRAFT LIMITED BROUGH YORKSHIRE ENGLAND

THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2540 JUNE 24, 1960

Regrettable Absence

Many people will have been greatly disappointed to learn last week that the flying programme planned for the 1960 S.B.A.C. Show will have no item contributed by the Royal Navy. For the past three years—ever since the Sea Hawks of No. 738 Squadron and the Gannets of Nos. 796, 825 and 737 Squadrons gave such a spirited display—the Fleet Air Arm's part in the proceedings has been a lively reminder of the important place of naval aviation in the general order of things. There can be little doubt that this will be sadly missed, not only by the hundreds of thousands of visitors to Farnborough on the public days, but by the more specialized audiences present earlier in the week.

This omission, however, is of the Service's own choosing. The Admiralty has decided that the Fleet Air Arm's current intensive schedule for the introduction of several new aircraft types into the Fleet's carriers would not permit it. The lengthy training and preparation that would be needed for Farnborough participation would, it has been explained, seriously prejudice the operational efficiency of the Fleet. It is, of course, good to hear that the Navy's aviation re-equipment programme is being pressed ahead with such dispatch and that outside "distractions" such as an invitation to participate in the World's premier air display—however tempting that must inevitably be—are not allowed to interrupt its smooth working.

All the same, Service aviation has come to be an important part of the S.B.A.C. flying programme, adding point, so to speak, to the technical advances that are represented by the mass of ancillary equipment displayed statically—much of which has application to military aircraft or owes its very existence to military developments. And when so many distinguished civil and military guests from abroad come to Farnborough every year, it seems all the greater pity that the Senior Service will not be there to make the flying programme properly complete.

A Matter of Urgency

In the seven days that have elapsed since this page was put to press for our previous issue, a number of aeronautical events and happenings of a widely diverse nature have found their way into the news and are duly recorded in our pages this week. For example, a British sailplane, flown by a member of the Argentinian team, has won the World Championship contest at Cologne; a British turbine-powered twin-engined, twin-rotor military helicopter has flown from London to Malta in the commendably short time (with refuelling stops) of twelve hours; and a new air-cushion-riding craft has successfully made its first hovering "flight" on the Isle of Wight.

Of all the items in the news last week, however, one of the most significant has been the release of the full text of the memorandum submitted to the Prime Minister by the British Interplanetary Society and outlining recommendations for a programme of space research that could be mounted by the United Kingdom. The proposals put forward are practical and realistic and, in the context of the subject concerned, would appear to be moderate enough.

It should be noted, though, that the Society's final recommendations were agreed in February and were formally put forward more than three months ago. As time goes by, there is no lessening of the urgency for a decision. Indeed, it is to be hoped that a positive statement on this vital subject will be forthcoming from the Minister concerned early in the new Parliamentary session which has now started.

B

Editor - - - - - THURSTAN JAMES
Deputy Editor - - - - F. T. MEACOCK

Founder Editor (1911-1939) *C. G. Grey*

Proprietors: TEMPLE PRESS LIMITED
Chairman and Managing Director:
ROLAND E. DANGERFIELD

Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

© Temple Press Limited, 1960. The proprietors will consider any written requests to reproduce articles and illustrations appearing in this journal. Comment and brief extracts which acknowledge *The Aeroplane and Astronautics* are permissible.

Matters of Moment

Rotary-wing Records

EN ROUTE to Idris in North Africa from A. and A.E.E. Boscombe Down for tropical trials, a Westland-Bristol Type 192 Belvedere last week set up two helicopter point-to-point records. Subject to official confirmation by the F.A.I., the helicopter covered the 850 nautical miles between London and Rome in 8 hr. 13 min. including stops, and the 1,220 n. miles between London and Malta in 12 hr. 6 min. also including stops. The provisional average speeds over these two distances were 103 kt. (118 m.p.h.) London-Rome and 100 kt. (115 m.p.h.) London-Malta; the overall average speed, excluding the intermediate stops, works out at 113 kt. (130 m.p.h.).

A crew of three was carried; the aircraft captain was Wg. Cdr. C. B. Brown, A.F.C., commanding officer of D Squadron at Boscombe Down, who was accompanied by Flt. Lt. G. W. Smith, M.B.E, as second pilot and M.Eng. A. E. Risby as flight engineer. The particular aircraft used is a fully operational version that has been undergoing Service clearance trials at A. and A.E.E.; tropical trials are part of this programme.

The flight to Idris was planned with a night stop at Malta. After an overnight positioning flight the 192 took off from Gatwick airport on Jne. 14 at 03.34 hrs. G.M.T. and flew non-stop 475 n. miles to Orange/Caritat in southern France. This leg of the trip was covered in 4 hr. 10 min. After a refuelling stop of 33 min. it took off for Pratica di Mare, Rome—375 n. miles away—where it touched down 3 hr. 30 min. later.

A refuelling stop of 41 min. was made at Rome before the 370-n. mile leg to Luqa, Malta, was flown in 3 hr. 12 min. The aircraft reached Luqa at 15.40 hrs. G.M.T.

Powered by two 1,650 s.h.p. Napier Gazelle shaft turbine engines, the Bristol Type 192 Belvedere has accommodation for up to 25 fully equipped troops or 6,000 lb. of internal freight. Its normal all-up weight has been given as 18,000 lb., but the take-off weight quoted for its flight to Malta was 19,860 lb. Its maximum cruising speed is 138 m.p.h.

In giving details of this noteworthy flight, the company is at pains to emphasize that the helicopter used was in no way specially equipped for the purpose and was similar to the production aircraft being built at Weston-super-Mare for the Royal Air Force. Indeed, it points out that had the helicopter been specially equipped for a record flight an increased speed, and greatly reduced flight times, could have been recorded.

Air Marshal Sir Ralph Sorley, deputy chairman and managing director of de Havilland Propellers, Ltd., who retires on June 30.

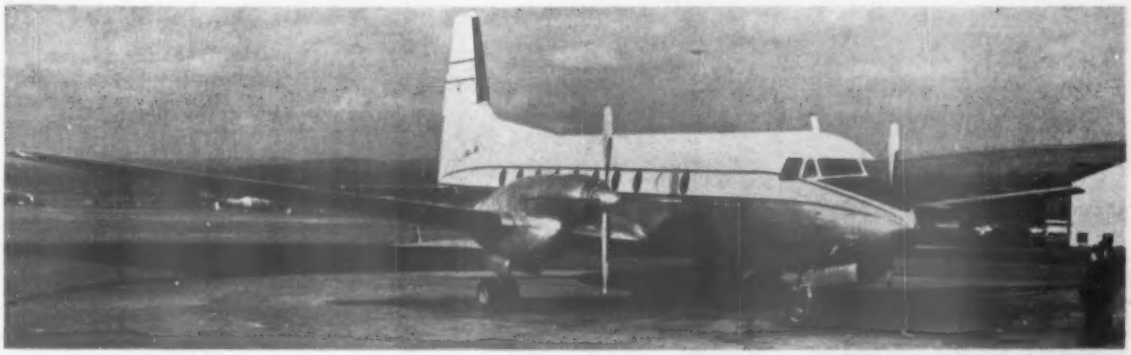
A Well-earned Retirement

AIR MARSHAL SIR RALPH SORLEY, K.C.B., O.B.E., D.S.C., D.F.C., F.R.Ae.S., deputy chairman and managing director of de Havilland Propellers, Ltd., is to retire at the end of this month. He will be succeeded as managing director by Mr. H. G. Sturgeon, O.B.E., who has been deputy managing director of the company since 1957.

When Sir Ralph joined the de Havilland team in 1948 he already had had a long and distinguished Service career. Born in 1898, and educated at University School, Hastings, he went into the Royal Naval Air Service in 1914 and transferred to the Royal Air Force in 1918. After the First World War he served with No. 6 Squadron in Mesopotamia from 1920 to 1922 and with No. 14 Squadron in Palestine from 1923 to 1924. He

NEWCOMER.—The Britten-Norman Cushioncraft has now been "flown"—details and a cut-away drawing are on pages 778 and 779. Here, top left, Mr. F. R. J. Britten (left) discusses the craft with Mr. N. D. Norman. Above, the Cushioncraft making a "tethered" hover. The machine is powered by an automobile engine and has accommodation for three people—including the pilot.

Photographs copyright "The Aeroplane and Astronautics"



NEW SHAPES.—Top, the Avro 748 prototype (two Rolls-Royce Darts), seen here at Woodford, should have made its first flight by the time these words are read. Bottom, Westland's first prototype Westminster (two Napier Elands) has now had its open frame fuselage faired in: it made its public début in this guise at the R.N.A.S. Air Day at Yeovilton on Jne. 18.

was then posted to the Marine Aircraft Experimental Establishment at Felixstowe as a test pilot and this was followed by a similar posting to the A. and A.E.E. at Martlesham Heath. In 1927 he went to the Directorate of Technical Development at the Air Ministry for two years and subsequently he commanded No. 8 Squadron in Aden from 1931 to 1932.

After a spell in Air Staff (Operational Requirements) from 1933 to 1935, Sir Ralph commanded a number of R.A.F. Stations and from 1940 to 1941 he commanded the A. and A.E.E. which, by that time, had moved to Boscombe Down. During this period he was closely associated with the development of all types of aircraft and armament. He was a firm protagonist of the military monoplane and urged a new approach to armament problems in the light of the higher speeds at which the coming generation of monoplane fighters and bombers would operate. Indeed, he had much to do with development of the eight-gun fighter concept and official specifications which led to the Spitfire and Hurricane; with the turret-armed Defiant; and the first power-operated gun turrets for bombers.

In 1941, Sir Ralph was appointed Assistant Chief of Air Staff (Technical Requirements). He became Controller of Research and Development at the Ministry of Aircraft Production in 1943 and was a member of the Air Council. Later he was appointed A.O.C.-in-C. Technical Training Command, an appointment he held until retiring from the R.A.F. in 1948.

Upon leaving the Service, Sir Ralph joined de Havilland Propellers as chief executive and a director. In 1949 he was appointed managing director and in 1955 he joined the board of the parent company, de Havilland Holdings, Ltd.; the following year he was appointed deputy chairman of the Propeller company.

An Avro First Flight

AS this issue went to press the first flight of the Avro 748 feeder-liner was imminent. A photograph of the prototype appears above. Powered by two Rolls-Royce Dart RDa.6 turboprops, each giving 1,740 e.h.p. at take-off, this aircraft has a maximum take-off weight of 33,000 lb. and has accommodation for up to 44 passengers. It cruises at 230 kt. at 20,000 ft. and will carry a 9,666-lb. payload over a range of 585 n.m.

The rapid design and construction of the Avro 748 has shown how fast a large company can produce a relatively simple aircraft if it is developed as a private venture. It is just under 18 months since drawing-office work began on this "Dakota-replacement" aircraft. A second prototype is scheduled to fly in November or December this year and production aircraft will follow at monthly intervals from early in 1961. It is expected that the Avro 748 will receive A.R.B. certification for airline operation by next April.

Civil orders for the aircraft so far cover three for Skyways, two for B.K.S. and three for Aden Airways. The Aden order is for the Series 2 version which will have the more powerful Dart RDa.7. This gives 2,105 e.h.p. for take-off. A prototype Series 2 will fly in the middle of next year.

A licence agreement has also been signed for production in India of a military Avro 748. This aircraft, now designated the Avro 757, will be a military version of the Series 2 civil type, from which it differs mainly in having a strengthened floor and large freight door. Its all-up weight will be 37,500 lb.

B.O.A.C. Appointments Confirmed

SIR MATTHEW SLATTERY, whose likely appointment as chairman of B.O.A.C. was forecast in our issue for Jne. 3, will succeed Sir Gerard d'Erlanger on Jly. 29. As expected, the appointment is to be on a full-time basis, whereas Sir Gerard has been acting in a part-time capacity since becoming chairman in May, 1956. The post of deputy chairman, previously full time, will in future be part time and will be occupied by Sir Wilfred Neden, who joined the B.O.A.C. board in December, 1958.

At present chairman and managing director of Short Bros. and Harland, and a director of the Bristol Aeroplane Co., Ltd., Sir Matthew Slattery had a distinguished Naval career from 1916 to 1948. His Wartime posts included those of Director of Air Material, Admiralty; Director-General of Naval Aircraft Development and Production, and Vice-Controller (Air) and Chief of Naval Air Equipment, Admiralty.

Sir Wilfred Neden was Chief Industrial Commissioner at the Ministry of Labour until retiring in 1958. He will continue to give special attention to labour relations within the Corporation.

Three other new part-time members of the B.O.A.C. board have been named. They are: Mr. J. A. Connel, vice-chairman of Unilever; Mr. Lionel Poole, until recently general secretary of the National Union of Boot and Shoe Operatives; and Sir Walter Worboys, chairman of B.T.R. Industries, Ltd. They replace Mr. Keith Granville (who has succeeded Sir George Cribbett as chairman of B.O.A.C. Associated Companies), the late Sir John Stevenson and Mr. H. L. Newlands.

HISTORY REVIVED.—At the recent Middle East dinner a rare copy of "The Gnome" was autographed by some of those present. The issue—dated 1917—contained a celebrities competition; we wonder how many of them survive? Autographs include those of the president, Air Vice-Marshal Borton, Maj. Henry Petre, Maj. J. R. McCrindle, Air Cdre. Sir Vernon Brown, Capt. A. D. C. Carroll, J. E. Carpenter, W. A. E. Featherstone, R. Chevallier Preston, and A. Swinton-Vaughan the Hon. Sec. This annual function is always a highlight for the oldest of the R.A.F. Dining Clubs, and this year's function was no exception.

Getting Better

ALL his friends will be pleased to know that Stewart Scott-Hall, Head of the United Kingdom M.o.A. Staff and Scientific Adviser to the High Commissioner, Australia, is now on the way to a steady recovery after a major abdominal operation. For the past six months he has been seriously ill, but trusts that his visits to various hospitals are now finished.

Mr. Scott-Hall has been in Australia for the past year and was previously Scientific Adviser to the Air Ministry in London for three years. He has been actively connected with aviation ever since he left Imperial College in 1926 and joined the Aerodynamics Department of R.A.E. Farnborough.

All his friends in aviation wish him the best of luck in his latest solo attempt. If past achievement and singleness of purpose, coupled with an indefatigable pioneering spirit, have much to do with it, he has every chance.

Electronic Exports

DURING the past six months, Britain's aero-electronics industry has sold its products to no fewer than 22 countries abroad. This represents a valuable contribution to the overall aviation export business and is a welcome reminder of the growing status of this particular industry. As the S.B.A.C. recently pointed out, it is significant that for its forthcoming 1960 Farnborough show, the area of the stands in the outside equipment display—where much of the larger radar equipment is set out—has had to be increased beyond the already sizeable area occupied last year. Indeed, at this year's exhibition the display of radio and radar aids—to say nothing of other electronic equipment on show—promises to be even more comprehensive than in previous years.

Aviator Yachtsman

PEOPLE who remember Francis Chichester, the well-known aviator of the early '30s, will be interested to know that he is taking part in the solo-transatlantic yacht race, which started on Jne. 11 from Plymouth, to New York. He is the oldest competitor and his yacht, "Gipsy Moth III," is the largest in the race.

From the age of 18, when he emigrated to New Zealand, Francis Chichester has been a lone pioneer. He tackled many jobs in N.Z., including gold-digging and forestry, and eventually started an aviation company. By the time he was 27 he decided to learn to fly—which he did in six months. His attempt to beat Bert Hinkler's solo record flight from England to Australia failed, though he did complete the flight.

In 1931, in a Gipsy Moth fitted with floats, he made the first solo flight from New Zealand to Australia, via Norfolk and Lord Howe Islands. Despite the fact that his aircraft was sunk in a gale and had to be rebuilt with only the help of Lord Howe Islanders, he eventually reached Australia, whereupon he immediately headed for Japan. A very unfortunate accident right at the end of this remarkable flight caused the aircraft to be completely wrecked and Francis Chichester himself suffered multiple fractures from which it took many years to recover fully.

During the War he worked in the Air Ministry teaching and devising new navigational techniques as, despite many attempts, the R.A.F. were unable to accept him owing to weak eyesight. His peacetime occupation has been map publication, and he started sailing in 1953 with his first yacht, "Gipsy Moth II," in which he took part in 16 ocean races.

W.J.A.C.'s Successful Anniversary

SOME 2,000 people went to White Waltham on Whit-Monday to see the Women's Junior Air Corps' Twenty-first Anniversary Grand Flying Display—including every small boy and every ice-cream vendor for miles around. The weather was kind, if not generous, and everybody got their money's worth.

The programme began with a march past, and then a fly past of the W.J.A.C.; then there was a buzz past of Moths of one sort or another of the Tiger Club. Next a breathtaking show of aerobatics by Michael Popoff in the Archbishop. After a flour bombing competition by the W.J.A.C. came some most impressive formation flying by Turbulents of the Tiger Club—really close-in they were, too. There were Chipmunk aerobatics, sailplane aerobatics, more flour bombing, tied-together formation flying, more Turbulents—this time in a splendid mock race round the aerodrome—a crazy flying show by Nepean Bishop as an inept pupil, Jeffrey Quill and Bill Bedford's glorious Spitfire-Hurricane dog-fight, parachutists and, best of all, a demonstration of that rare sport, balloon jumping.

The R.A.F. had got a small balloon, decked it out like Humpty Dumpty, and inflated it so that it had just a little less lifting power than the weight of the man it carried, who was thus enabled to make enormous slow leaps, 30 or 40 feet high and a 100 or more long, as he drifted slowly across the airfield. It looked the most enormous fun, and the balloon was secured by a long line to a Land-Rover, so that nothing could go wrong.

The crowd loved it all, and Auto-Sport, Ltd., who organized it, can feel proud of its success.—J.G.

Semyon Lavochkin

ONE of Russia's leading aircraft designers, to whom is credited the first Soviet supersonic jet type, Semyon Alexsevich Lavochkin, died suddenly on Jne. 9 at the age of 59. He graduated from a technical school in Moscow in 1927, after service in the Red Army and after many years in the Soviet aircraft industry, headed a fighter design bureau shortly before World War II.

This produced the LaGG series of fighters in association with Gorbunov and Gudkov, and these were further developed by Lavochkin into the radial-engined La-5. An all-wood monoplane of outstanding manœuvrability, the La-5 was a contemporary of the Focke-Wulf FW190 and, although slower, achieved considerable success in action against the Luftwaffe. It was the favourite mount of Ivan Koshedub, Russia's leading fighter pilot, who scored most of his 63 victories in Lavochkin types. The La-7, in which he scored 17 kills, is still preserved in Moscow's House of Aviation.

Post-war development of the series resulted in the La-9 and La-11, but although Lavochkin then switched to jet designs, none of his later types has been identified as reaching service. The La-15, a contemporary of the MiG-15, was produced to a similar specification, and with a generally similar appearance, except for the shoulder position of its swept-wing. Although this was probably the aircraft referred to by the Russians as the first to fly supersonically in the Soviet Union, and was thus faster than the MiG-15, it did not go into production.

Aviation News in General

ROLLS-ROYCE LICENCE? — It is reported that Rolls-Royce and Hispano Suiza are discussing a licence agreement for the production of Tyne turboprops in France. These would power the Transall C-160 military transport and Breguet Atlantic maritime reconnaissance aircraft. No comment on these reports is available from Rolls-Royce.

SOUTH MARSTON.—Deliveries of Supermarine Scimitars from the South Marston works of Vickers-Armstrongs (Aircraft), Ltd., are due to be completed in September. These works are not included in the British Aircraft Corporation; they come under a new company, Vickers-Armstrongs (South Marston), Ltd. Its activities include the production of research reactors and reactor simulators, as well as development of a type of hovercraft.

CANADIAN STARFIGHTERS. — Canadiar, Ltd., has placed sub-contracts for the CF-104 fighter worth nearly 40% of the total value of the 200 airframes being built by the company. Recent sub-contracts totalling nearly $5 million have been awarded to the Canadian Car Co., Ltd., for forward fuselage installations; to Dominion Rubber Co., Ltd., for fuel-tank cells; to Jarry Hydraulics, Ltd., for main undercarriage units and hydraulic-system assemblies, and to Dowty Equipment of Canada, Ltd., for nosewheel undercarriages. The first Canadair CF-104 is due to fly next spring and is similar to the F-104G ordered for the West German, Belgian and Netherlands air forces.

I.A.L. CONTRACTS.—Three new contracts have recently been awarded to International Aeradio—for the establishment and operation of a civil Flight Information Centre at Aden; for duty and instructing in Cyprus (three A.T.C. officers); and for duty at Accra, Ghana (two A.T.C officers and one operations officer). I.A.L. will shortly be operating in 30 countries.

BIG AIR DROP.—A load of 35,055 lb. —claimed to be the largest ever dropped from an aircraft—was parachuted from a Lockheed C-130 recently during tests by the U.S.A.F. Air Research and Development Command. Attempts will be made to drop 45,000 lb. The previous record was 32,000 lb.

ADVANCED TRAINER.—The U.S.A.F. has taken delivery of the first production Northrop T-38A Talon for evaluation at Edwards A.F.B. The rear cockpit of this prototype T-38, containing test equipment, has been painted over.

NOISE EVIDENCE.—The committee appointed by the Minister for Science " to examine the nature, sources and effects of the problem of noise and to advise what further measures can be taken to mitigate it " is now ready to receive evidence from persons and organizations with special interest or experience in this subject. Anyone wishing to give evidence should write to the committee's secretary, Mr. R. S. Matthews, Ministry of Health, Savile Row, London, W.1.

LONDON ZONE CHANGE. — The boundary of the London Control Zone has been revised. It is now an approximately rectangular-shaped area symmetrically disposed around L.A.P. and bounded by the traffic zones of Woodley, Booker, Elstree and Wisley. Hatfield, Radlett and Leavesden, in addition to Woodley and Elstree, are now outside the revised zone. The London Terminal Control Area is unchanged.

KEEPING IT QUIET.—Noise abatement rules to be made by the F.A.A. for Washington's new Dulles International Airport will include the use of ILS glide-path approach patterns at all times, to avoid low, noisy approaches being made by large aircraft. Entry and departure flight paths will be established over least populated areas, and a 1,000-ft. thick border of trees round the airport will provide sound-proofing of ground level airport noise.

EUROCONTROL.—The seven European countries (Britain, Italy, France, Belgium, West Germany, Holland and Luxembourg) concerned in Eurocontrol have now agreed in principle to international upper-air-space control and to the establishment both of Eurocontrol and of a Permanent Commission for the Safety of Air Navigation.

MERCURY TRACKING.—A tracking station for the United States Mercury man-in-space project is being built in Zanzibar. It will be one of a chain of 14 such stations to be established at a total cost of £15 million.

BRITISH ALBM?—Mr. Watkinson, the Defence Minister, said on Jne. 17 that " we might well consider developing a British weapon to be carried by Victor 2 bombers in the late '60s." He was speaking during a television interview.

RE-ENTRY STUDIES. — Lockheed has received contracts from the U.S.A.F. Air Research and Development Command worth approximately £167,000 for studies of the re-entry and landing of spacecraft.

RECORD FLIGHTS.—The Westland-Bristol Type 192 Belvedere which last week set up two helicopter point-to-point records between London, Rome and Malta. Details of the flights are recorded on page 756.

WOLVERHAMPTON TESTS. — Wolverhampton Aero Club will hold its navigation and " crash landing " competitions this Sunday, Jne. 26. They were postponed from Jne. 12 because of bad weather.

COLLECTORS' PIECES.—To commemorate the 50th anniversary of its foundation, the Aero Club de Portugal has issued some new medallions. These may be acquired from the club, at Avenida da Liberdade, 226, Lisbon. They cost £3 2s. 6d. for the bronze piece, £6 10s. for the silver medallion.

CAYLEY LECTURE.—Major Oliver Stewart, M.C., A.F.C., the editor of *Aeronautics*, will give the seventh Sir George Cayley Memorial Lecture at the R.Ae.S. Brough Branch on Nov. 9. His subject will be " Forty Years of Aviation Writing."

(*More news on page 777*)

Mediterranean Argosy

ARMSTRONG WHITWORTH'S A.W.650 Argosy is now very close to certification, with about 1,500 hr. of test flying completed. British certification demands 300 hr. of route proving, and the fourth aircraft, G-APRN, has just completed the first three phases of this operation; phase one comprised 50 hr. and phases two and three 75 hr. each. During these phases numerous European flights were made, and over the four days Jne. 14-17 the third phase was completed with a 4,700 nautical miles flight from Elmdon to Beirut via Rome and Athens with the return journey via Athens, Malta and Nice.

Between phases of route proving the Argosy is given a check one, and after completion of this G-APRN was due to leave on the fourth phase, which will be in two parts totalling 100 hr. In the first half of phase four the Argosy will fly to Beirut and then do 50 hr. flying over the routes of Trans-Arabia Airways, which is likely to be the first operator of the type and have a fleet of three. Following these flights, the aircraft will make a return flight Beirut-U.K.-Beirut, after which another 50 hr. will be flown, possibly with Trans-Arabia pilots participating.

The total route proving will amount to about 75,000 miles and the rate at which it is being flown is equal to a utilization of about 2,500 hr./year. During the fourth phase the Argosy will visit Kuwait, Bahrein, Teheran and Cairo, and will encounter very high temperatures as well as an airport with an elevation of nearly 4,000 ft.

During the route proving to date there have been no delays due to unserviceability of the aircraft.

On last week's Mediterranean flight I had the opportunity of seeing the Argosy in simulated service, and during that flight the only delay, and that of less than 2 hr., was due to a fire warning wire which had to be replaced. In regular operation, with proper spares provisioning, even this delay would have been of shorter duration.

During the journey the Argosy was carrying an average of 22-24 "passengers" and crew with a total equivalent commercial load of a little over 7,000 lb. Figures for the different sectors were remarkably consistent and performance obtained was very close to the curves already published by the manufacturer.

A typical breakdown of weights is that given here for the Rome-Athens sector. Basic weight, 51,126 lb., adjusted service weight, 52,098 lb., load, 7,085 lb., zero fuel weight, 59,183 lb., water methanol, 700 lb., fuel, 20,000 lb., and take-off weight, 79,883 lb. compared with maximum permissible 88,000 lb.

Temperatures at airports and at cruise level were high throughout the flight as will be seen from the sector figures. These are as follows:—

Elmdon—Rome. 952 nautical miles; flight-plan time, 4 hr. 33 min; actual airborne time, 4 hr. 31 min. and block time, 4 hr. 39 min.; take-off weight, 83,098 lb.; fuel, 23,000 lb.; runway elevation, 325 ft.; runway temperature, ISA; field length required, 4,200 ft. Cruise altitude, 19,500 ft.; cruise level temperature, ISA plus 6-11°C.; average cruise T.A.S., 220 kt.; wind, plus 15 kt.; cruise consumption, 700 lb./engine/hr.; estimated landing weight, 70,068 lb.; total fuel used, 13,250 lb. The alternate was Nice, 286 nautical miles, and total endurance, 8 hr. 1 min.

Rome—Athens. 645 nautical miles; flight-plan time, 3 hr. 2 min.; actual airborne time, 3 hr. 6 min. and block time, 3 hr. 20 min.; take-off weight, 79,883 lb.; fuel, 20,000 lb.; runway elevation, 423 ft.; runway temperature, ISA plus 15°C.; field length required, 4,300 ft. Cruise altitude, 15,500/17,500 ft.: cruise level temperature, ISA plus 11°C.; average cruise T.A.S., 220 kt.; wind, plus 9 kt.; cruise consumption, 720 lb./engine/hr.; estimated landing weight, 70,568 lb.; total fuel used, 9,470 lb. The alternate was Salonica, 173 nautical miles and total endurance, 6 hr. 43 min.

Athens—Beirut. 628 nautical miles; flight-plan time, 2 hr. 53 min.; actual airborne time, 3 hr. 3 min. and block time, 3 hr. 17 min.; take-off weight, 79,768 lb.; fuel, 20,000 lb.; runway elevation, 90 ft.; runway temperature, ISA plus 14°C.; field length required, 4,300 ft. Cruise altitude, 15,500 ft.; cruise level temperature, ISA plus 12°C.; average cruise T.A.S., 225 kt.; wind, plus 25 kt.; cruise consumption, 700 lb./engine/hr.; estimated landing weight, 71,058 lb.; total fuel used, 9,477 lb. The alternate was Nicosia, 129 nautical miles, and total endurance, 6 hr. 50 min.

It will be seen that the Rome—Beirut sector could have been flown non-stop with the 7,000-lb. load and still with a take-off weight 8,000 lb. below maximum. The total distance would have been 1,273 nautical miles; this compares with the 1,735 nautical miles shown in A.W.A. curves for a maximum weight take-off and carrying 7,000 lb.

Beirut—Athens. 623 nautical miles; flight-plan time, 3 hr. 11 min.; actual airborne time, 3 hr. 19 min. and block time, 3 hr. 31 min.; take-off weight, 79,553 lb.; fuel, 20,000 lb.; runway elevation, 85 ft.; runway temperature, ISA plus 15°C.; field length required, 4,200 ft. Cruise altitude, 14,500 ft.; cruise level

temperature, ISA plus 13°C.; average cruise T.A.S., 225 kt.; wind, minus 15 kt.; cruise consumption, 750 lb./engine/hr.; estimated landing weight, 69,598 lb.; total fuel used, 10,383 lb. The alternate was Salonica, 173 nautical miles, and total endurance, 6 hr. 47 min.

Athens—Malta. 502 nautical miles; flight-plan time, 2 hr. 38 min.; actual airborne time, 2 hr. 30 min. and block time, 2 hr. 36 min.; take-off weight, 77,553 lb.; fuel, 18,000 lb.; runway elevation, 90 ft.; runway temperature, ISA plus 13°C.; field length required, 4,000 ft. Cruise altitude, 16,000 ft.; cruise level temperature, ISA plus 12°C.; average cruise T.A.S., 225 kt.; wind, minus 19 kt.; cruise consumption, 730 lb./engine/hr.; estimated landing weight, 69,423 lb.; total fuel used, 7,590 lb. The alternate was Idris (Tripoli), 232 nautical miles, and total endurance, 6 hr. 4 min.

Malta—Nice. 630 nautical miles; flight-plan time, 3 hr. 14 min., actual airborne time, 3 hr. 2 min. and block time, 3 hr. 10 min.; take-off weight, 79,718 lb.; fuel, 20,000 lb.; runway elevation, 297 ft.; runway temperature, ISA plus 15°C.; field length required, 4,100 ft. Cruise altitude, 16,500 ft.; cruise level temperature, ISA plus 10°C.; average cruise T.A.S., 230 kt.; wind, minus 23 kt.; cruise consumption, 725 lb./engine/hr.; estimated landing weight, 69,773 lb.; total fuel used, 9,257 lb. The alternate was Ajaccio, 122 nautical miles, and total endurance, 6 hr. 46 min.

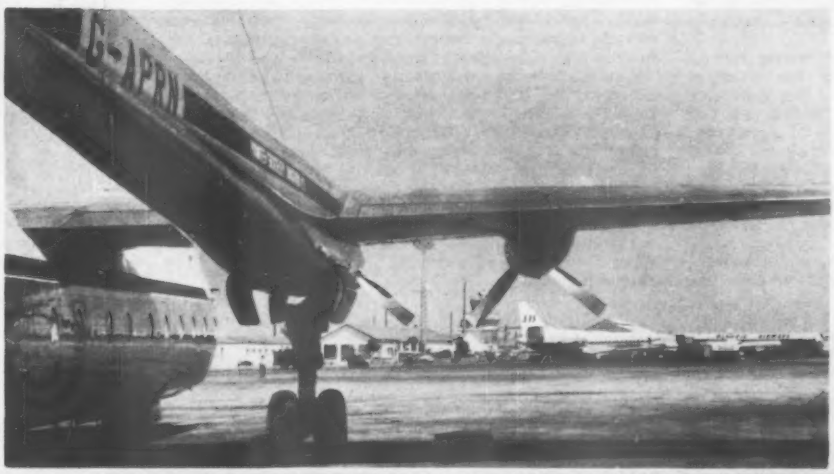
Nice—Elmdon. 694 nautical miles; flight-plan time, 3 hr. 41 min.; actual airborne time, 3 hr. 30 min. and block time, 3 hr. 36 min.; take-off weight, 79,718 lb.; fuel, 20,000 lb.; runway elevation, 10 ft.; runway temperature, ISA plus 14°C.; field length required, 4,300 ft. Cruise altitude, 16,500 ft.; cruise level temperature, ISA plus 10°C.; average cruise T.A.S., 230 kt.; wind, minus 30 kt.; cruise consumption, 725 lb./engine/hr.; estimated landing weight, 68,283 lb.; total fuel used, 10,570 lb. The alternate was Gatwick, 99 nautical miles, and total endurance, 6 hr. 39 min.

The entire flight of about 4,700 nautical miles was made with a total airborne time of 23 hr. 1 min. with a total fuel consumption of 69,997 lb. All flight-plan times were from 1,000 ft.

Eric Franklin, Armstrong Whitworth's chief test pilot, and Bill Else, deputy chief test pilot, flew the aircraft, and representatives of the A.W.A. technical and sales departments were on board as was a representative of the A.R.B. An enormous amount of hard work was done throughout the trip, every possible detail was recorded and there was even an airborne meeting followed by the writing of reports.

Placard speeds noted on the flight deck were:—VNE 0-1,000 ft. 265 kt. I.A.S. decreasing 5 kt. per 1,000 ft. to 25,000 ft.; VNO 0-1,000 ft. 230 kt. I.A.S. decreasing 4 kt. per 1,000 ft. to 25,000 ft.; VFE take-off 180 kt. approach 158 kt.; landing 135 kt. VLG operating and extended 158 kt.

The entire trip was most enjoyable and instructive, and the Argosy proved comfortable for prolonged periods of flying. Noise level is very reasonable in spite of the large volume of unsoundproofed cargo hold. Stage lengths flown and temperatures encountered were fairly representative of those the Argosy would meet on Middle East routes, although at some times in places such as Kuwait temperatures will be considerably higher.—JOHN STROUD.



Left, the Argosy ready for departure from Athens on the outward flight; the Viscount in front of Olympic Airways' hangar was operating the inaugural Misrair Cairo-London service.

Below, this scene taken on arrival at Rome is representative of the activity at all stops with refuelling, handling and other ground crew acting as an enthusiastic welcoming party. In the picture at the top of the opposite page, the Argosy is at Beirut International Airport.

Air Transport

Caribbean Communications

ON June 10 the new aeronautical communications system linking the eastern islands of the Caribbean was officially inaugurated and the first call, from Barbados to Trinidad, was made by the Federal Minister of Communications.

This multi-channel VHF system was planned and installed by International Aeradio, in conjunction with Pye Telecommunications, Ericsson Telephones and Creed and Co., and provides an automatic telephone and teleprinter service for airlines operating in the Caribbean area. The network has a capacity for 12 separate and simultaneous voice channels, plus 12-18 teleprinter channels. The main route runs from Trinidad through Grenada, St. Vincent, St. Lucia, Dominica, Antigua and St. Kitts, with a link to Puerto Rico and North America.

Work on the system began four years ago, after a survey of the problems in the area.

Better Than Expected

DURING last week-end the U.S. Civil Aeronautics Board announced fare increases for trunk domestic services which will be effective from Jly. 1. The increases average about 5%—which is lower than those sought by some of the airlines, but probably higher than was generally expected. The announcement came as something of a surprise, since earlier this month there was some fear amongst the airlines that the increases might be delayed until the autumn.

The present fares were temporarily extended several months ago by the C.A.B. and these extensions were due to expire on Jne. 30. The extensions were ordered by the Board because it had not yet completed its three-year study of the fare situation—the General Passenger Fare Investigation.

In a short Press statement at the end of April, the Board said it had decided to approve the findings of its examiner, who had concluded that an average rate of return on investment of 10.6% would be fair for the 12 trunk airlines and a figure of about 10.5% was adopted. The major domestic carriers have been earning much less than the average return approved by the Board, and in 1959 United, American, T.W.A. and Eastern—the so-called "big four"—earned little more than 6%. So the 5% average increase in fare level should bring the earnings up to the agreed figure.

Requests to the C.A.B. had varied, with the majority of the carriers asking for a 4-6% increase plus an additional $1 per ticket, but with Delta asking only for the ticket supplement and with T.W.A. asking for an across-the-board fare increase of 10%. These requests had been suspended pending the G.P.F.I. decisions.

The 12 airlines involved in the fare increases are, in addition to the "big four," Capital, Delta, Northeast, Northwest, Braniff, Continental, Western and National. It remains to be seen how the decision will affect Capital Airlines' difficulties over its repayments to Vickers-Armstrongs. Capital's president has said that an increase of 4%, plus $1 per ticket, would, in 1959, have yielded another $7 million in operating income—which would have been enough to have covered the operating deficit and provided about $4.5 million to pay-off equipment mortgages.

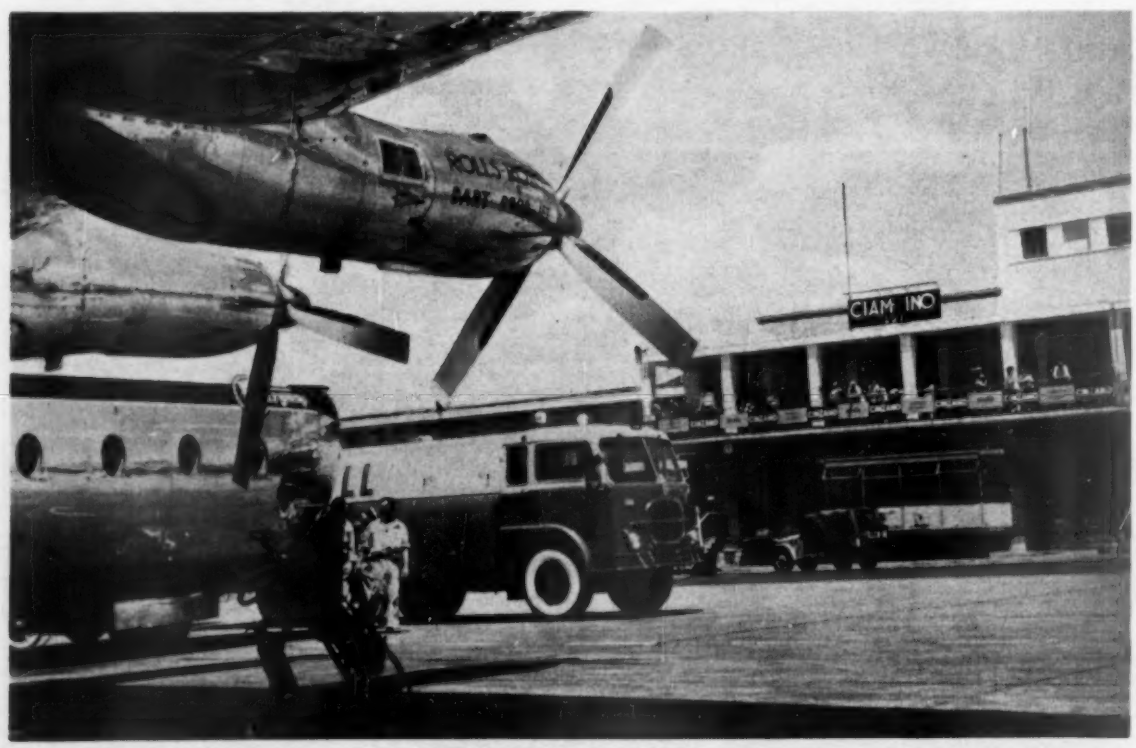
Hiatus

THERE is something odd and not a little disturbing about the great silence which seems to have descended on the British manufacturing and airline industries. Whereas a year ago they were, by comparison, talking their heads off about plans and projects, they now give the impression that they are waiting for something and are afraid even to whisper in case they fail to hear the sound of the dropping of a pin by the Minister of Aviation.

They are, indeed, waiting—the manufacturers for some government orders and the airlines, presumably, for some route rights—but it would surely be a better policy to carry on normal conversation whilst the new opportunities are being worked out. The silence is uncomfortable and is liable to give the outsider the idea that nobody is doing anything but waiting.

Meanwhile, in the independent airline business the re-organization goes quietly on. Just as the recent resignation of two principal executives of Hunting-Clan Air Transport seemed to confirm a revised status quo, so the unannounced departure of the chief executive of Transair, Mr. Gerald H. Freeman, must be taken to mean that this organization has lost, or is losing, the remains of its independence.

There is nothing really unexpected about this chain of events but it is disturbing to see the departure of good men at a time when the airline industry might be expected to need all its available experience.



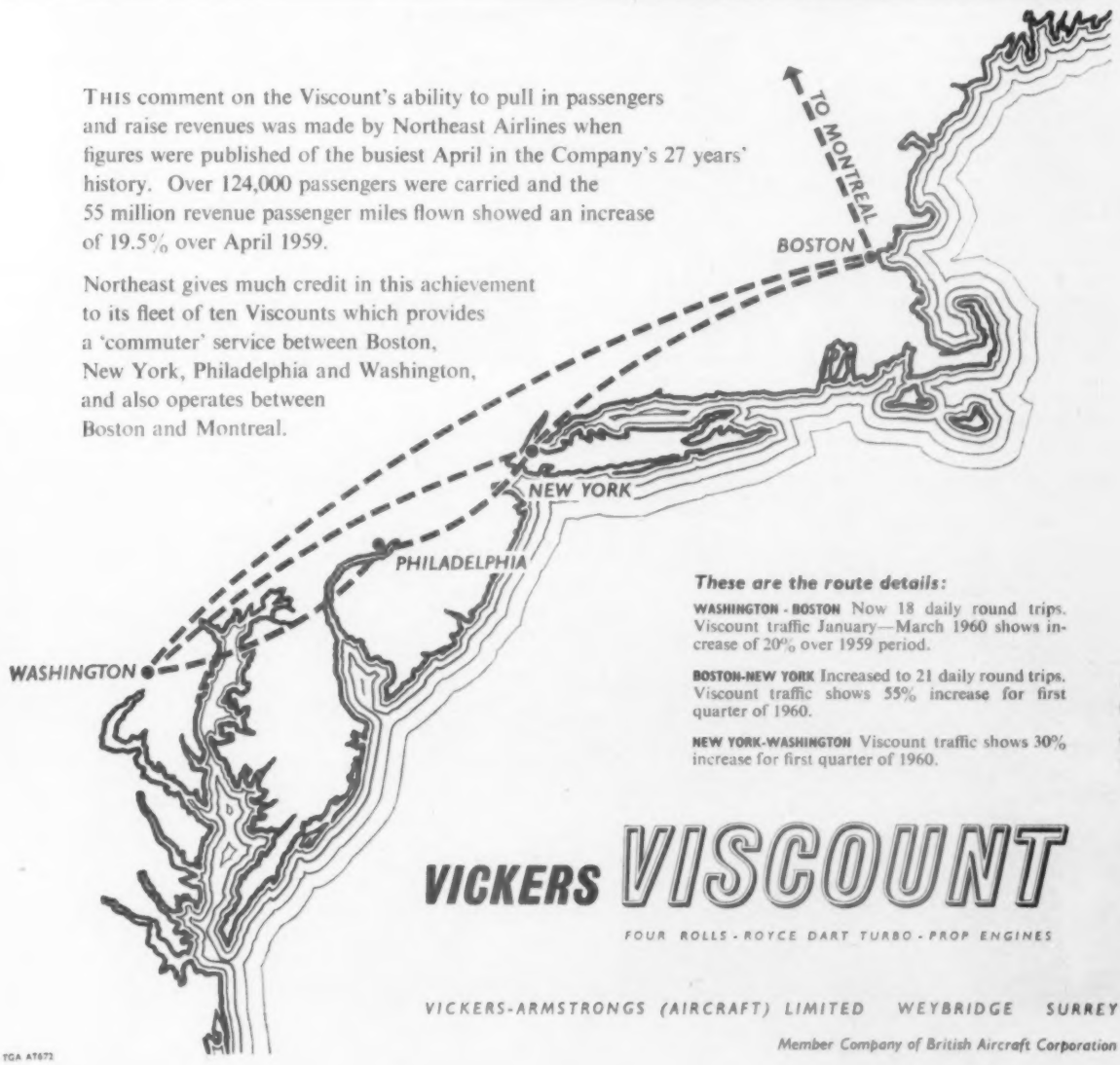
PROVING FLIGHT.—The Armstrong Whitworth Argosy on the apron at Ciampino Airport, Rome, during the series of route proving flights described on the previous two pages.

Northeast Airlines praise Viscount contribution to record April figures

'Strong Public Acceptance of the Viscount'

THIS comment on the Viscount's ability to pull in passengers and raise revenues was made by Northeast Airlines when figures were published of the busiest April in the Company's 27 years' history. Over 124,000 passengers were carried and the 55 million revenue passenger miles flown showed an increase of 19.5% over April 1959.

Northeast gives much credit in this achievement to its fleet of ten Viscounts which provides a 'commuter' service between Boston, New York, Philadelphia and Washington, and also operates between Boston and Montreal.



These are the route details:

WASHINGTON - BOSTON Now 18 daily round trips. Viscount traffic January—March 1960 shows increase of 20% over 1959 period.

BOSTON-NEW YORK Increased to 21 daily round trips. Viscount traffic shows 55% increase for first quarter of 1960.

NEW YORK-WASHINGTON Viscount traffic shows 30% increase for first quarter of 1960.

VICKERS VISCOUNT

FOUR ROLLS-ROYCE DART TURBO-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

Member Company of British Aircraft Corporation

TGA A7672

C

Esso

Esso's calculated hustle helps when

PRESTWICK PLANS A SECURE FUTURE

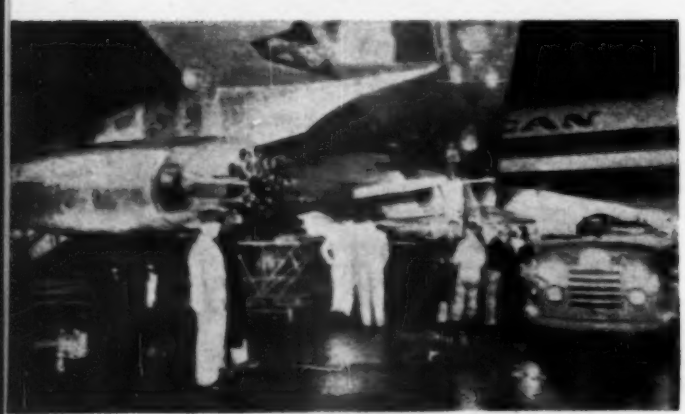
A REPUTATION for good weather gained Prestwick the title of the pilot's friend. For the same reason Prestwick has become Scotland's international airport, as well as a main staging place for transatlantic traffic, and a highly important military base. Coupled with the airport's diversionary role and importance to Scotland's economy, its use by domestic and international airlines, as well as by U.S. and British military aircraft, foretell immense development of Prestwick under the ægis of the Ministry of Aviation. It is also important as the home base of Scottish Aviation Ltd., where their aircraft are built and overhauled. Canadian Sabre aircraft are also serviced there.

No simple pattern or one single characteristic emerges as all-important at Prestwick. The needs are diverse. Demands for fuels, lubricating oils, de-icing, hydraulic and other fluids and specialised greases are similarly diverse. Shrewd planning, and estimates with large safety factors, are vital to keeping up the Esso reputation for calculated hustle.

Airline demands can be foretold weeks and months beforehand from schedules, but supplying the needs of large U.S.A.F. transports and of British military aircraft puts Esso refueller crews to a far severer test. Yet the staff copes adequately by planning for the unknown quantity, with reserve crews and refuelling vehicles constantly ready to go into action at short notice.

In reality, however, none of this is 'off the cuff'. The foundation of 15 minutes' attention to a Boeing of U.S. Military Air Transport Service was laid ten or fifteen years ago. It was then that Esso research in England anticipated the needs of the large jet-engined aircraft flying to-day. Esso laboratories have, in fact, supplied turbine fuels of 40 different specifications to engine builders all over the world for evaluation and trial, not only as regards performance on the testbed, but also under the only true testing conditions—during take-off, cruise, and all conditions of flight. Three of these specifications have emerged as more important than the rest. This relative importance has been shown by British and American demands for AVTUR, AVTAG, and AVCAT under D.E.R.D. specifications in this country, and J.P. numbers in the U.S.

Underwing fuelling of this new aircraft contrasts with the method shown in the other photograph on this page. Esso service at Prestwick is geared to meet contrasting needs.



Distinct in their characteristics, these turbine fuels are supplied to distinct categories of user. Each is 'tailor-made' to suit the varying but highly specific needs of civil and military operators. Many established specifications in the aviation world today therefore started as new products in Esso research labs.

This is progress. It can be provided for by genius, inspiration, or even Edison's 90 per cent. perspiration, which is another way of saying a refusal to be beaten by a problem. And though progress through research is vital to aviation, it is factually of no greater importance than the planned effort necessary to keeping liners in the air. Before that can begin to happen there

Esso refuelling crews at Prestwick are trained to know the exact details of almost every existing type of aircraft — to supply all requirements safely — FAST!

is an imperative need for years of planned movement of men, machines, ships and other resources as well as technical and scientific predominance with unceasing development . . . all smoothly co-ordinated to meet and produce superior results at competitive prices not only for airline operators, but also for government bodies and the local authority concerned.

Prestwick has fortunately emerged from a period of indecision as to its importance for the future. Plans are speedily maturing for the acceptance of more and yet more traffic, building success upon success. Esso is proud that a hydrant refuelling system embodying details perfected by Esso research is only one of many innovations to be installed, which will help to establish the importance of an airport that will prove to be the friend of pilots for very many years ahead.

Esso Petroleum Co. Ltd.,
Aviation Department,
36 Queen Anne's Gate, London S.W.1
Telephone: HYDe Park 7030

Military movements can hardly be scheduled. Plotted on a graph, the fuel demands at Prestwick would therefore show a series of irregular peaks which can be met only by calculated hustle.

A DC-8 of Scandinavian Airlines System arrives at Prestwick. Esso personnel are proud of the mutual understanding and respect that grows between them and the airliner crews of all nationalities.

BRITISH OXYGEN AVIATION SERVICES

win 'ARGOSY' contract for liquid oxygen system

Sir W. G. Armstrong-Whitworth Aircraft Ltd. have awarded to British Oxygen Aviation Services the contract for the liquid oxygen installation in the "Argosy" 660. Already production versions of the NA 39, Folland Gnat Trainer, Sea Vixen, Lightning and Gannet are flying with liquid oxygen breathing equipment and components supplied by British Oxygen Aviation Services. Through British Oxygen Aviation Services, BOC serve and service the world's aircraft.

BRIDGEWATER HOUSE · CLEVELAND ROW · ST. JAMES'S · LONDON S.W.1

Air Transport . . . .

A High-density Viscount Conversion

WITH the increasing emphasis on cheaper airline fare structures, more attention is being paid to high-density layouts, especially in the shorter-haul aircraft. One type which is receiving a fair share of successful attention at present is the Viscount 700 series. British European Airways are modifying their 701 fleet to 63-seat standard for domestic traffic within the British Isles; other operators have made or are projecting modifications.

A recent conversion of the normal 40-48-seat Viscount 700 to 61-seat layout has been made by Transair, a member company of the old Airwork Group which recently merged with Hunting-Clan Air Transport, Ltd., to form British United Airways. The aircraft converted are the two Viscount 736s purchased from Fred Olsen and formerly operated by Airwork. They are being used initially, under charter, to operate British European Airways' German domestic network based on Berlin.

Passengers in the new 736s find all the amenities provided in the more capacious 800 series. Space has been found for comprehensive meals and bar service, and for a rear lounge, a feature usually associated only with first-class air travel. The lounge occupies the space originally taken up by the rear baggage compartment, and seats four passengers. The main cabin seats 57, in Aerotherm seats arranged in 12 rows, five abreast with the exception of the last three rows which are four abreast.

The 57-seat main cabin in Transair's Viscount 736 conversion.

Other features in the new conversion include two toilets in the plane of the propeller discs; a Viscount 804-type buffet unit, with meal tray and hot drink containers positioned forward of the toilets on each side of the centre aisle; a bar unit incorporated inside the rear entrance vestibule; and a public-address system.

AIRPORT TRIO

On the right is a new air-to-ground picture of Cambridge Airport, which now has Customs facilities. The single runway is 3,400 ft. long with 300-ft. overruns at each end. Aids include VDF, radar and flarepath lighting. The grass area is normally used by non-radio aircraft.

Below is the main runway 10/28 at Leeds/Bradford Airport, Yeadon, seen on the approach from west to east and showing the new G.E.C. approach, threshold, runway and angle-of-approach lights (see last week's issue, p. 728).

Below is a scene from the apron at Le Touquet Airport, with the developed and extended terminal building for use primarily by Silver City vehicle-ferry and other passengers. Le Touquet is probably the third busiest airport in France.

Air Transport . . . .

P.V.D. in Practice

AIRBORNE experience with the Smiths Para-Visual Director system will leave the newcomer with a strong conviction that this new flight-director/instrument-flying concept must inevitably alter present ideas about weather minima and automatic-landing prospects. Certainly my own limited experience with the system—using it as a novice in the modern application of radio track guidance—suggested that the whole business of pattern-flying and ILS let-downs had, at least so far as handling was concerned, been shorn of most of its complications and need for concentration.

The system—described in our issue of May 13 (p. 579)—makes use of the sensitivity to movement of the extra-foveal regions of vision; in other words, it depends on the normal person's ability to see things "out of the corners of his eyes." Strategically placed indicators—in this case "barber's poles" which revolve to provide the effect of a pattern of black and white stripes moving along cylindrical display units—give the pilot gentle, unworrying, but nevertheless emphatic command instructions which are subconsciously noted even when he is looking ahead through the screen, downwards at the instrument panels, or almost anywhere within an angle of about 45° from dead ahead.

I spent about an hour in Smiths' Dove demonstrator, in which the P.V.D. equipment is installed—first as the onlooker of another newcomer's successful efforts to use the system, and then in the second pilot's seat. After a minute or less of familiarization and demonstration, I was led without difficulty by the P.V.D. around the holding and let-down patterns for Cranfield, on to the ILS approach towards Runway 22 and down to break-off height and eventual overshoot. During the second ILS approach the demonstration pilot took over, made a climbing turn to port and left me to deal with three streaming indicator patterns; I found no conscious difficulty in correcting the disturbances and was back on the glidepath in less time than it takes to read this sentence.

Now all this would have been a very simple exercise for a practised airline pilot using normal director and flight instruments in a familar let-down pattern. But I am not a practised airline pilot and I had no prior information about the patterns, or knowledge of the orientation of Cranfield's instrument runway. I didn't even know that the aerodrome circuits and holding patterns are right-handed.

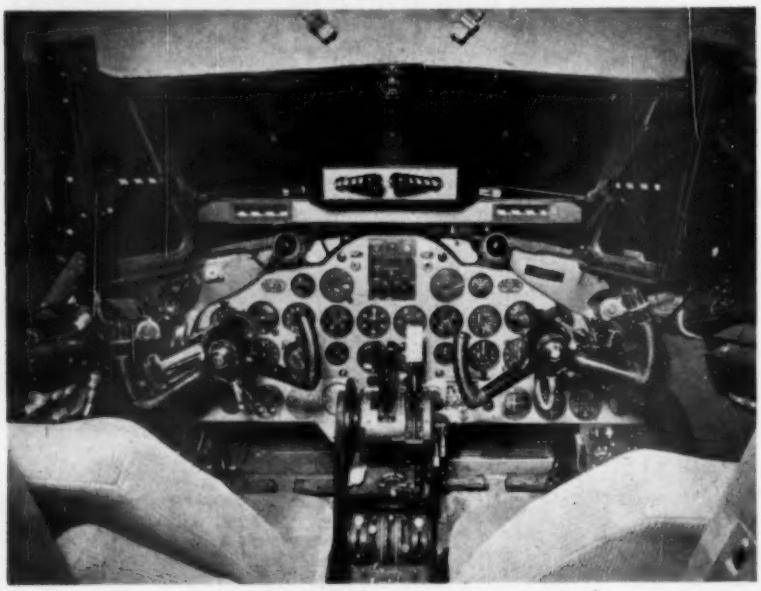
I simply did what the P.V.D. indicators told me to do, enjoyed the sight of a dappled Bedfordshire landscape, recognized one or two obvious landmarks such as the Cardington airship shed and Woburn Park, and eventually found myself lined up towards a runway and threshold lighting which I had never seen before. The only advantages which I brought with me to the exercise were 2,000-odd (very rusty) hours and a sound instrument-flying background from long-ago days.

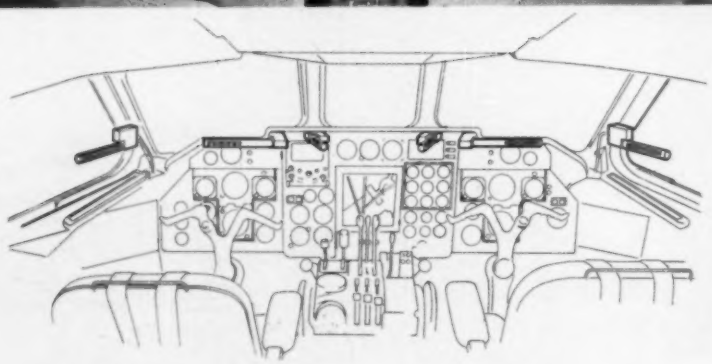
In short, the fact that an out-of-practice pilot could complete, without any particular difficulties, these simple little approach exercises leads to the supposition that much more complicated exercises, in more difficult conditions, will leave the airline pilot all his necessary tranquillity of spirit.

So far as first impressions of the P.V.D. are of value, I found that the lateral commands were insistent and natural from the very start, but that some thought was required to translate the pitch commands; when the stripes moved forward my initial instinct was to try to "hold them back" by raising the nose. I also found myself tending to reduce the rate of turn when the lateral stripes ceased to stream by; even though I knew quite well that a static indication meant that the existing flight condition was correct and had to be maintained, the cessation of indicator movement was instinctively translated as a reduction in demand. I would also have preferred the indicators to have had slightly more emphatic markings. We were flying, for the most part, in bright light and the pitch demands, in particular, did no more than trickle into my consciousness.

The Cranfield demonstration flights were not designed to do more than to show the fact that this method of displaying information is a practical one and is easy to follow even when attention is periodically being distracted. The facilities in the Dove installation are meagre in comparison with those which will be possible if the system is generally accepted; is designed as part of an overall director/autopilot complex; and scientifically placed in the flight decks of future transports. Nevertheless, one of the great advantages of the basic P.V.D. system is that it can be added, without major redesign, to existing control cabins—and nobody who has flown with it is likely to want to go back to the business of struggling with conventional

(Continued on page 765)

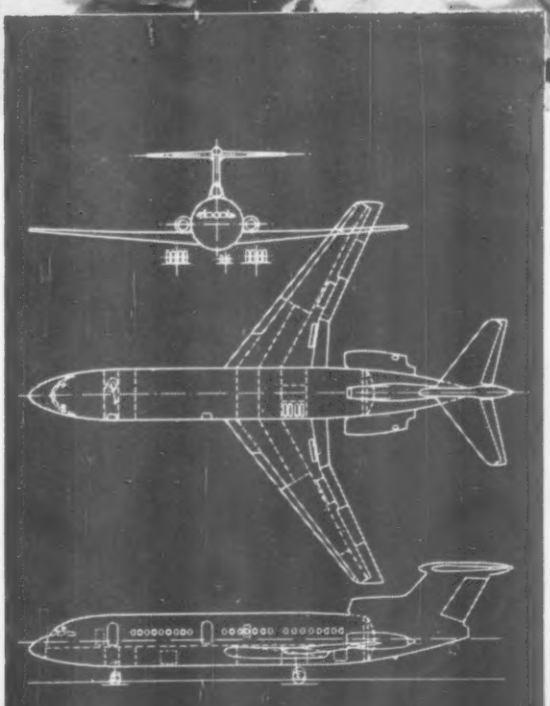




The Para-Visual Director system as installed (top) in Smiths' D.H. Dove demonstrator. Below is a drawing of the indicator layout as it might be arranged on the flight deck of the D.H. 121. The Dove's instrumentation includes the latest types of altimeter presentation, two-needle A.S.I.s and the Smiths Flight System as well as the P.V.D.

For B.E.A.—the D.H. 121

(Three Rolls-Royce RB.163 by-pass jet engines)



The ultimate 600 m.p.h. airliner for economical operations throughout the world.

Designed by the most experienced team. Powered by the best engines.

DE HAVILLAND

WE ARE READY FOR TO-MORROW

and the day after

We are the Aircraft Equipment Division of the English Electric Company Limited, and being a member of that group, are backed by their vast resources for research, development and production.

We stand today in the forefront of the development of electrical equipment for the aircraft that will be built tomorrow and the day after tomorrow.

We have the manpower and the know-how to take projects quickly from the drawing-board to the prototype stage, and have the facilities and techniques to put them equally rapidly into production.

And finally, we provide an efficient after-sales service which can be extended where necessary to meet new requirements.

'ENGLISH ELECTRIC' aircraft equipment

THE ENGLISH ELECTRIC CO LTD · AIRCRAFT EQUIPMENT DIVISION · PHOENIX WORKS, BRADFORD

A647

(*Continued from page 764*)

director displays during an instrument let-down and final approach.

The principal problems which the system is designed to solve are those concerned with transition from instrument to visual flight; with autopilot monitoring; and with the difficulties of maintaining correct attitudes, headings and flight-paths when flying manually on instruments and distracted by other events or duties.

The P.V.D. certainly seems to offer an entirely practical and relatively simple solution to all three problems. It is essentially a "head-up" display; it is untiring as a means of continuous monitoring; and, even if the sight of one or more of the display units is lost while dealing with some flight-deck emergency, so that the attitude or heading varies, recovery is quick and natural.

The system also has prospective value as a means of providing manual azimuth guidance for the interim auto-flare stage in automatic landing development and, if fed from different sources of information, can provide a third channel in a duplicated autopilot/flight system to make this, in effect, a triplex system.

A great many different methods were thought about and/or tried in practice before the present P.V.D. system was finalized. Aural guidance was considered, but this offered obvious difficulties in the provision of two-axis signals; tactile methods, such as palm ticklers, were also considered; variations of collimated pictorial windscreen displays were tried; and various forms of "streaming-light" displays were tested on a simulator before it was realized that such a continuous-movement guidance system could be extremely tiring. Even the present system was developed initially with its indications in (theoretically more logical) reverse of those finally decided upon as a result of trials. It seems that the specialists may have failed in the past to see the wood for the trees in this matter of flight-information presentation and have overlooked a fundamentally simple and logical solution to the problems.—H.A.T.

North Atlantic Results

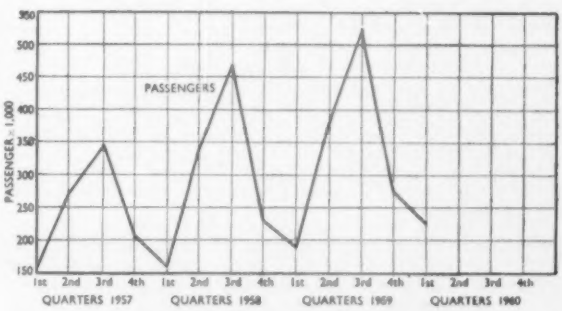
PASSENGER traffic and load factors on the North Atlantic demonstrated their customary troughs for the first quarter of 1960. But the troughs were substantially higher than those for the same quarter of 1959—with, for instance, an increase of 19.5% in the total passenger figure—and the traffic levels were, in fact, equivalent to those of the peak quarter of five years ago.

The biggest increase was that for cargo, with 10,073 tonnes carried—or 51.9% more than that for the first quarter of 1959—and with a 54% increase in the number of scheduled all-cargo flights.

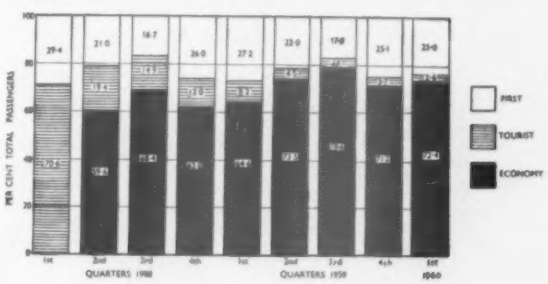
There were slight changes in the class proportions, with the tourist ratio dropping inevitably from 8.2% to 2.6%, economy increasing from 64.6% to 72.4% and first-class traffic remaining more or less static at about 25%.

FIRST QUARTER, 1960

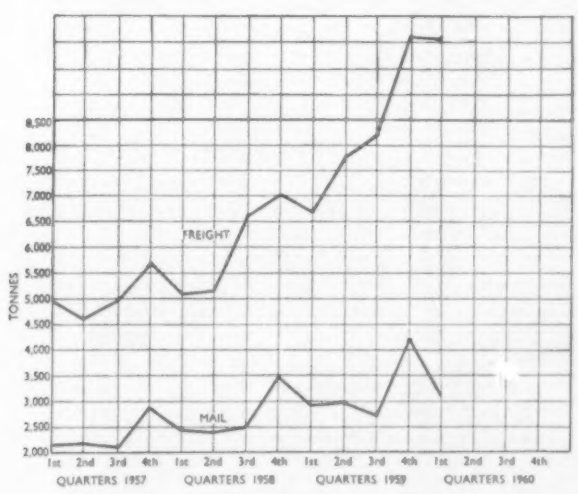
	Eastbound	Westbound	Total	% change on 1959
Scheduled flights ..	2,937	2,896	5,833	+ 5.4
Seats offered ..	199,529	202,001	401,530	+17.3
Revenue passengers				
First	29,258	27,635	56,893	—
Tourist	2,350	3,522	5,872	—
Economy ..	75,819	89,443	165,262	—
Total	107,427	120,600	228,027	+19.5
Pass. load factor (%)	53.8	59.5	56.8	+ 1.0
Freight (kg.) ..	4,676,597	5,396,302	10,072,899	+51.9
Mail (kg.)	1,708,794	1,411,990	3,120,784	+10.8



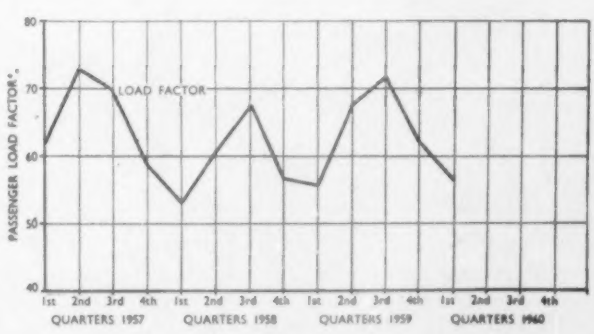
North Atlantic passenger totals quarter by quarter.



The changing class ratios since the introduction of economy services early in 1958. The tourist class will disappear this year.



The steadily rising freight and static mail loads during the past three years of North Atlantic operation.



The seasonal variations in load factor.

The Fighting Services

A.O.C. Gibraltar

GROUP CAPTAIN J. M. N. Pike, D.S.O., D.F.C., is to become Air Officer Commanding, Gibraltar, next month with the acting rank of Air Commodore.

Senior Air Staff Officer at Air Headquarters, Malta, since November, 1957, Gp. Capt. Pike previously commanded R.A.F. Kinloss. Following a course at the R.A.F. Flying College, Manby, in 1954, he commanded R.A.F. St. Mawgan.

University Air Squadron Camps

SUMMER camp training for members of the 17 University Air Squadrons started earlier this month with the squadrons of St. Andrew's, Bristol, Cambridge, Edinburgh, Glasgow and London moving to R.A.F. Tangmere, Kinloss, Martlesham Heath, Hullavington, Thorney Island, and R.N.A.S. Brawdy, respectively. All squadrons, divided into two sections, will attend camps in the period between Jne. 12 and Sept. 24.

Of the remaining squadrons, Aberdeen and Hull are going to R.A.F. Martlesham Heath; Durham to R.A.F. Gaydon; Leeds and Southampton to R.A.F. Valley; Liverpool to R.A.F. Thorney Island; Manchester to R.A.F. Cottesmore; Nottingham to R.A.F. Tangmere; Oxford to R.A.F. West Malling, and Queen's (Belfast) to R.A.F. Lyneham.

School of Photography Tie

A UNIT tie has been designed for the R.A.F. School of Photography, one of the oldest schools in the Service. Those entitled to wear it are: all members of trade group 14 who have passed through the School, all permanent staff of three months' standing and all present trainees. The tie comprises a repeated motif of the School's gold crest upon a dark blue background.

It may be obtained, price 12s. (12s. 6d. post free), from the Adjutant, School of Photography, R.A.F. Wellesbourne Mountford, Warwickshire. Cheques or Postal Orders should be made payable to "School of Photography Tie Fund" and crossed.

E.F.T.P.S. at E.T.P.S.

TEN staff and 14 students of the U.S.A.F.'s Experimental Flight Test Pilots School, under the school's commandant, Maj. R. C. Lathrop, and accompanied by Col. R. E. Phelan, Chief of Staff at Edwards A.F.B., where the school is located, recently spent four days at the Empire Test Pilots School at R.A.E. Farnborough. They are on a short tour of Europe. They were welcomed by Capt. K. R. Hickson, A.F.C., R.N., who after several years as Cdr., Flying, at R.A.E., took over command of E.T.P.S. from Gp. Capt. R. E. Burns, C.B.E., D.F.C., who has joined the R.A.F. contingent in Washington.

As the result of a Working Party's finding, the E.T.P.S. is to continue in its present form for at least another five years, when its status and requirement will be reviewed. Among the new aircraft the school will be getting to replace earlier types are the Javelin FAW.8, Hunter F.6, as well as another Canberra T.4. They will also be receiving two Hastings, Sycamores to replace Dragonflies and, when it becomes available, an Argosy.

WREN.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. L. W. G. Gill, D.S.O., to the Department of the Chief of the Air Staff; Wg. Cdr. A. V. Breese to the Department of the Air Member for Supply and Organisation.

Bomber Command: Wg. Cdr. M. J. Beetham, D.F.C., A.F.C., to Headquarters, No. 3 Group, for operations duties; Wg. Cdr. G. F. Reid, D.F.C., to R.A.F. Coningsby, to command the Flying Wing; Wg. Cdr. A. J. Scott, O.B.E., D.F.M., to R.A.F. Upwood, to command the Flying Wing.

Fighter Command: Wg. Cdr. H. G. Davies to R.A.F. Middleton St. George, as Wg. Cdr. (Administration); Wg. Cdr. E. W. Deacon, D.S.O., D.F.C., A.F.C., to R.A.F. Leeming, as Wg. Cdr. (Administration); Wg. Cdr. H. F. O'Neill, D.F.C., to R.A.F. Leuchars, to command the Flying Wing; Wg. Cdr. W. H. Mills, D.F.C., to R.A.F. Duxford, to command No. 64 Squadron; Sqn. Ldr. D. B. Wills, D.F.C., to R.A.F. Waterbeach, to command No. 46 Squadron, with acting rank of Wg. Cdr.

Coastal Command: Wg. Cdr. S. P. Austin to Headquarters as Command Accountant.

Transport Command: Wg. Cdr. P. M. Walker, A.F.C., to R.A.F. Abingdon, to command the Administrative Wing.

Flying Training Command: Wg. Cdr. A. W. Horne, D.F.C., A.F.C., to the R.A.F. College, Cranwell, as Deputy President of the R.A.F. Selection Board; Wg. Cdr. A. C. Langdon to R.A.F. Thorney Island, to command the Training Wing; Wg. Cdr. A. W. Tarry to the R.A.F. Flying College, Manby, for directing staff duties; Sqn. Ldr. F. G. Harley, M.B.E., to No. 1 Flying Training School, R.A.F. Linton on Ouse, as Senior Technical Officer, with acting rank of Wg. Cdr.

Technical Training Command: Wg. Cdr. J. D. Beresford to Headquarters, No. 22 Group, as Wg. Cdr. (Training); Sqn. Ldr. J. R. Simpson to No. 4 School of Technical Training, R.A.F. St. Athan, for accounts duties, with acting rank of Wg. Cdr.

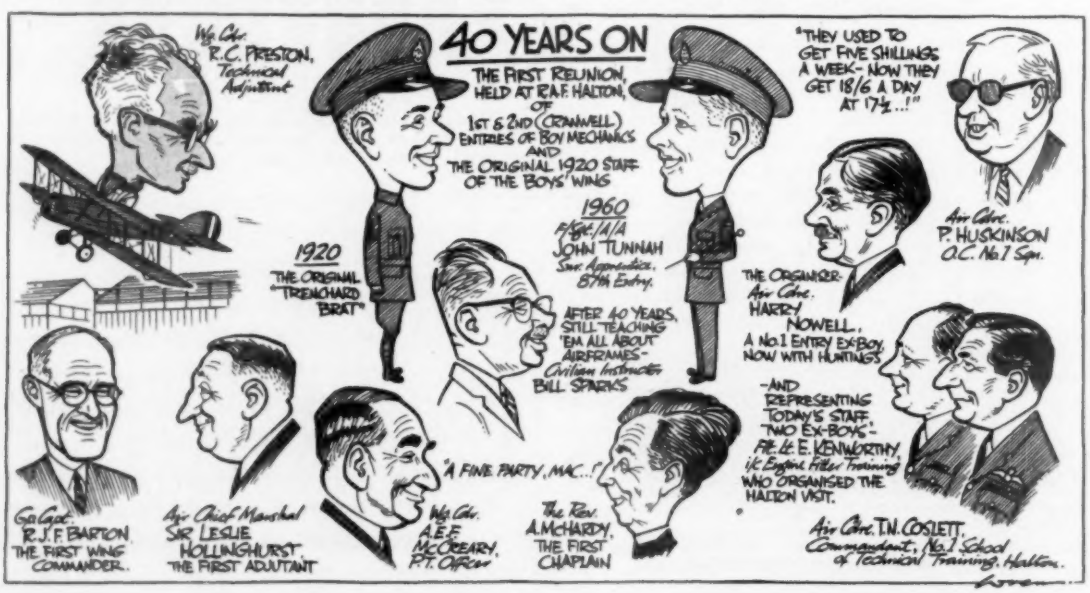
Signals Command: Wg. Cdr. R. G. W. Oakley, D.S.O., D.F.C., A.F.C., D.F.M., to Headquarters for work study duties.

Maintenance Command: Gp. Capt. A. P. Chamberlain to Headquarters as Command Engineering Officer; Wg. Cdr. P. A. S. Thompson, D.F.C., to No. 5 Maintenance Unit, R.A.F. Kemble, to command.

More Service News

R.A.F. Oakington.—Air Cdre. W. T. Coles, S.A.S.O. No. 3 Group, Bomber Command, was the reviewing officer at the passing out parade of No. 144 Provost/Vampire Course at No. 4 Flying Training School, Oakington, on Jne. 15. Flg. Off. J. B. Griffith won the Cup of Honour, the de Havilland Flying Trophy and the Aerobatic Trophy, while the Ground School Cup went to Plt. Off. D. C. Brown.

Home Air Command.—The First Lord of the Admiralty, the Rt. Hon. Lord Carrington, recently completed a short tour of Home Air Command. Establishments visited included the Headquarters, Flag Officer Flying Training; R.N.A.S. Yeovilton; R.N.A.S. Lee-on-Solent; the Headquarters, Flag Officer Air (Home), and the R.N. Aircraft Yard at Fleetlands.


40 YEARS ON
THE FIRST REUNION, HELD AT R.A.F. HALTON, OF 1ST & 2ND (CRANWELL) ENTRIES OF BOY MECHANICS AND THE ORIGINAL 1920 STAFF OF THE BOYS' WING
Wg. Cdr. R.C. PRESTON, Technical Adjutant
1920 THE ORIGINAL "TRENCHARD BRAT"
1960 AC1/A/A JOHN TUNNAH Senr Apprentice, 87th Entry.
AFTER 40 YEARS STILL TEACHING 'EM ALL ABOUT AIRFRAMES - Civilian Instructor BILL SPARKS
"THEY USED TO GET FIVE SHILLINGS A WEEK - NOW THEY GET 18/6 A DAY AT 17½..!"
Air Cdre. P. HUSKINSON O.C. No.1 Sqn.
THE ORGANIZER Air Cdre. HARRY NOWELL, A No.1 ENTRY EX-BOY NOW WITH HUNTINGS
-AND REPRESENTING TODAY'S STAFF, TWO EX-BOYS - Flt. Lt. E. KENWORTHY, i/c Engine Fitter Training WHO ORGANISED THE HALTON VISIT.
Air Cdre. T.N. COSLETT, Commandant, No.1 School of Technical Training, Halton.
Gp. Capt. R.J.F. BARTON THE FIRST WING COMMANDER.
Air Chief Marshal SIR LESLIE HOLLINGHURST THE FIRST ADJUTANT
Wg. Cdr. A.E.F. McCREARY, P.T. Officer
"A FINE PARTY, MAC...!"
The Rev. A. McHARDY, THE FIRST CHAPLAIN

NATO's First Operational Fiat G-91s

MOST people interested in aviation in this country probably know of the Orpheus-powered Fiat G-91 as the standard lightweight tactical strike fighter for NATO forces. But information generally available here has, to date, been confined to the Bretigny trials of 1957 or the evaluation programme carried out in the Udine area of Northern Italy, last summer. On this last occasion 10 G-91s established a remarkable record of serviceability—both for engines and airframes—during five extremely arduous days' flying.

These 10 aircraft were, in fact, attached to the 103rd Light Tactical Fighter Squadron which has been based at Treviso, some 20 miles north west of Venice, since the beginning of May last year. The unit was originally formed in February, 1959, when No. 103 Squadron of the Italian Air Force was re-equipped with Fiat G-91s. It is thus the first operational unit in NATO to be equipped with these aircraft and, consequently, has been responsible for much of the groundwork necessary for the smooth introduction of the new aircraft into general service.

Now, with some 30 pilots and 21 aircraft on the strength, 103 Group is one of the units under the 56th Tactical Air Force. This is attached to the combined Italian-American 5th Allied Tactical Air Force—which in turn comes under the aegis of NATO Command.

Without going too much into old history, it is worth recalling that the Fiat G-91 came about as a result of the SHAPE requirement issued in 1954 for an aircraft to cover the specialized tactical support rôle. One of the 10 projects submitted to meet that requirement—and all but one of these were designed around the Bristol Siddeley Orpheus—the G-91 was the winner among the finalists which competed at Bretigny. Like its two competitors—the Etendard VI and the Taon—the G-91 has a wide-track undercarriage, swept wings, low-pressure tyres for operation from grass, tail parachute, air brakes, ejection seat, and a shoulder-high tailplane.

Powered by the Orpheus 803 which gives 5,000 lb. of thrust for a weight of only 835 lb., the G-91 is a purposeful-looking machine—large, for instance, compared with the Gnat—with a length of just over 34 ft., a height of 13 ft. and a normal gross take-off weight in the 11,500-lb. class.

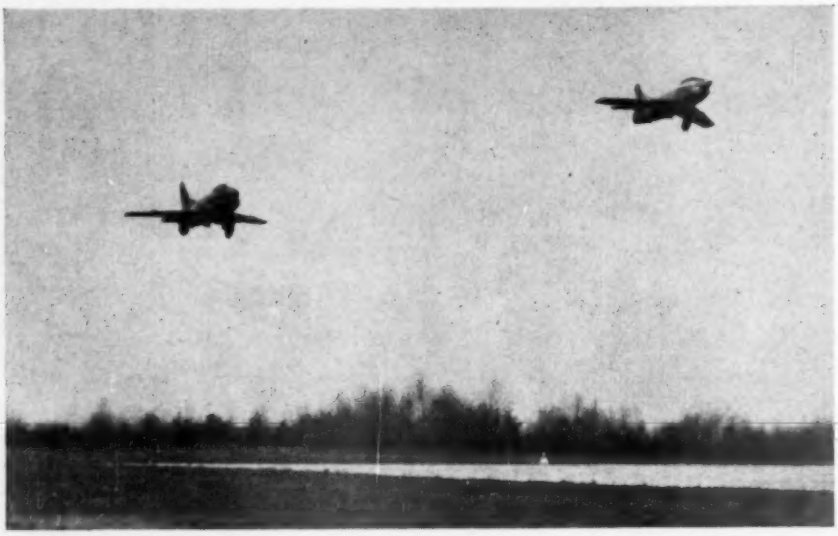
From conversations with aircrew and ground personnel at Treviso, it is evident that the G-91 is a very popular aircraft with the Squadron. Captain Giuseppe Sobrero, 103's Second-in-Command and Squadron Training Officer, speaks enthusiastically of the machine's handling qualities on the ground, its take-off performance and general lightness and response to the controls.

During take-off—normally accomplished in pairs at Treviso—the aircraft unsticks at around 2,000 ft. with normal stores; on grass, slightly more length is required depending on ground conditions. The rate of climb is brisk and four minutes to 25,000 ft. seems an acceptable figure. In landing, aircraft come in at a low angle of approach, around 130 knots and with a relatively flat angle of attack. The brake parachute is streamed in every instance as routine procedure, and the touch-down-to-stop distance on tarmac and grass is about 1,500 ft. and 1,000 ft. respectively.

Given average weather conditions a total of 200 flying hours

Capt. Giuseppe Sobrero, Second-in-Command and Squadron Training Officer of the Italian Air Force's 103rd Light Tactical Fighter Squadron.

Fiat G-91s of 103 Squadron being fuelled; the farthest aircraft is a reconnaissance version. At the top of the page is a general view of the apron and control tower at Treviso.



A good deal of the flying by 103 Squadron at Treviso is done in pairs. Here, two G-91s fly over with wheels and flaps down.

in a week for the Squadron is not considered exceptional. Much of the flying time is given over to training new members of the Squadron—and also pilots of another unit which is soon to be equipped with G-91s. Equally important is the perfection of various operational techniques which have been evolved over the past 12 months.

According to Capt. Sobrero, although all training is carried out to a basic programme it is left to individual flight commanders to elaborate as they think fit. Naturally the time taken to complete the syllabus varies with individuals but, on a rough reckoning, a normally experienced pilot would need some 70 hr. in the air to become proficient enough in ground-attack, navigation and weapon-handling techniques to meet Squadron requirements.

Pre-flight training consists of basic school-room work, ground handling and simulated take-offs. With the tactical support rôle as the G-91's raison d'être, it follows that much emphasis is put on quick, accurate map reading and navigation. Training starts at altitude—20,000 ft. or thereabouts—and the pupil then works his way down in stages to 500 ft. These exercises are completed initially within relatively low speed brackets and, as training progresses, the speeds are gradually built up so that, eventually, the pilot becomes familiar and then adept at low-altitude flying at speeds well in excess of 500 knots.

On a typical "dummy run" the pupil might be expected to attack a target some 150 miles fom base. Following an approach within a flight envelope of, say, 3,000-6,000 ft., the aircraft loses height to cross the bomb line at 500-1,000 ft. at a speed of 550 knots and upwards. Obviously, large fuel allowances for repeated runs over the target are not catered for, and swift

and successful completion of the operation calls for a fair degree of skill.

A certain amount of night flying is also done by trainees. Operationally, however, this is required solely for deployment purposes.

The Squadron attaches a deal of importance to quick turn-round times, refuelling, rearming and the like. To appreciate the importance of this, it is necessary to visualize the G-91 in its fullest context as a weapons system.

Basically, the Tactical Support Unit provides a highly mobile, easily deployed fighting force, capable of operating off semi-prepared strips close behind the battle lines, and striking at targets in hostile territory over distances of up to 150 miles from base with the normal range of NATO weapons. Thus each unit can be subdivided into a series of smaller units or cells of up to five aircraft—each with its own first-line technical support, and capable of functioning quite easily 30 miles or so away from the others.

Second-line technical support is located within an area accessible to all the operational cells and would, in all probability, be centred near the Squadron headquarters, while liaison between all parties is maintained by two liaison aircraft and/or helicopters.

By having a very rugged engine and airframe, and by tailoring the ground equipment of each unit to give the smoothest and quickest service, it is possible to achieve a very high degree of operational efficiency. Consequently a whole range of specialized equipment has been designed specifically to keep the G-91 in the air. This consists of fuel bowsers and trailers, crane and armament trucks, radio vehicles, trucks fitted with special equipment to offer up the quick-change armament panels on the side of the fuselage, together with a host of other ingenious devices.

Moreover, as all the vehicles are designed to be mobile over relatively rough terrain, it is possible to disperse them well under cover while the aircraft are actually airborne. Something of the order of three to four 50-min. missions can be completed in a day by each operational cell and turn-round times are as little as six minutes.

High powerplant serviceability is naturally a vital prerequisite and in this respect the Orpheus has proved itself to be exceptionally reliable. Put in the simplest terms, the fact that it has about one-third the number of separate components as in many engines of comparable size, is a boon to the service engineer—not only because there are fewer things to go wrong but fewer things to inspect and maintain. It has been said, in fact, that engine changes can be effected within two hours.

Above, Capt. Alessandro Calvi, one of the Squadron's flight commanders.

It is too early to pass final judgment of the Fiat G-91. But the fact still remains that already considerable operational experience with these aircraft has now been built up by the pilots and ground crews of 103 Squadron. Next July the first West German G-91 Squadron is expected to be formed, and it will then be possible to gain a still clearer picture of this extremely promising new weapons system which has undoubtedly got away to a flying start.

Above, ready for take-off. In this view the large chin intake for the Orpheus turbojet is noticeable; the aircraft on the right is a G-91R reconnaissance version.

Left, an Orpheus ready for a test run. This photograph shows the excellent powerplant accessibility that is provided with the fuselage tail section removed.

Right, a head-on shot of the Fiat G-91 brings out the clean lines of the fuselage cross section and shows the thin wing to advantage.

Icing Problems Under Discussion

LAST week, for the third time, D. Napier and Son, Ltd., organized one of its annual Ice Protection Conferences; it was held at Luton Airport on Jne. 14. President of the conference was Mr. C. L. Cowdrey, manager of the Napier establishment at Luton, and the chairman was Mr. H. G. Conway, chief engineer and joint deputy managing director of Short Bros. and Harland, Ltd., Belfast. One Russian, one Canadian and three British papers were read.

O. K. Trunov and M. S. Egorov of the Civil Aviation Organization in Moscow discussed "Results of Experimental Flights in Natural Icing Conditions and Operation of Aircraft Thermal Ice Protection Systems." Among the points they covered were the effect of icing on the performance, stability and controllability of aircraft and the thickness of ice that could be tolerated.

From Canada came C. Kenneth Rush, of the National Research Council, to speak on "Icing Problems of High-speed Aircraft." One of the most interesting features of his lecture was a discussion of the new problems which might be introduced by supersonic aircraft of unconventional shape.

Wings with leading-edge separation were discussed. Over slim-delta wings vortex sheets originate at the sharp leading-edges; these lead to unusual icing problems. The basic icing characteristics of such wings with separated flow have been established by tests in the N.R.C. 4½ ft. icing tunnel.

With such wings, ice forms over the top surface at all angles of attack, but particularly at high angles. It forms at a greater rate along the paths of the vortices on the upper surface and the ice pattern tends to outline the vortex path. There is a heavy growth of ice on the sharp leading edges.

Flight Test Problems

B. T. Cheverton, of Napiers, dealt, in his paper, with "The Icing Research Aircraft." He surveyed the requirement for such aircraft, which simulate icing conditions by flying in clear air below 0° C. and producing an artificial cloud immediately upstream of the test specimen.

A range of aircraft has been used for this purpose in the past, both for engine and aerofoil icing tests. But most of these were prepared for a single rôle, unlike the Napier Lincoln which has been specially adapted to permit the testing of a variety of sections and systems. [This aircraft was described in THE AEROPLANE AND ASTRONAUTICS of Sept. 25, 1959.]

Recent tests with this aircraft have been made to prove the performance of the pulsating boot system as applied to the Avro 748 and the Spraymat electro-thermal de-icing system of the Argosy. The aircraft is now being converted to carry a tailplane section of the Blackburn NA.39.

Mr. Cheverton devoted most of his paper to discussing the simulation technique; the variables which affect icing performance include indicated airspeed, climate, water droplet size, ambient temperature, effective incidence and heat input. All of these factors were analysed in detail.

"Clouds and Aircraft Icing" was the title of the lecture by R. F. Jones, of the Meteorological Office. He discussed the formation of clouds; those which offered an icing threat; the supercooled water content of clouds and its forecasting; and statistics of aircraft icing. There is much work to be done on such statistics; according to Mr. Jones, "the collection of comprehensive statistics of the supercooled water content of clouds in all parts of the world is an enormous task which, in the scientific sense, has hardly even begun."

R. Briggs and G. Hinton-Lever, of British European Airways, discussed "Airline Ice Protection Requirements." The title of their paper was, however, somewhat misleading, as they referred only to de-icing and anti-icing of the airframe before engines are started and thereafter up until the point when power is first reduced following take-off.

B.E.A. has been working for 5-6 years to produce the equipment, fluids and techniques for ground de-icing of aircraft. The requirements are access to all parts of the aircraft; a sure method of removing ice, snow or frost; and a method of protecting the aircraft against further accretion. As a short-haul airline B.E.A. has particular problems; most of its fleet returns to the home airport at night and there are often 50 or more aircraft to dispatch by midday the next day. During winter in Southern Britain the temperature often fluctuates just above or below freezing point and does not help this situation.

During little more than a week's operation in January, 1955, 4,000 gallons of various de-icing fluids were used at London Airport and the cost of fluid alone amounted to at least £4,000. A considerable quantity of the fluid de-iced the tarmac.

As a result of that experience a manufacturer was asked to produce a compound which would be both economical and more effective in its inhibiting properties. The manufacturer produced a jelly which when heated and diluted with water to any desired strength could be sprayed like any other fluid. The heat of the mixture assists in the thawing process and the compound then absorbs the water and renders any further accretion easily removable.

A Russian delegation attended Napier's international conference on ice protection on Jne 14. Left to right here, in front of the company's icing research aircraft, are: M. S. Egorov and O. K. Trunov (joint authors of the Russian paper); the Russian interpreter; B. T. Cheverton of Napier; C. L. Cowdrey of Napier, the conference president; V. Alinov; and B. Bujanov.

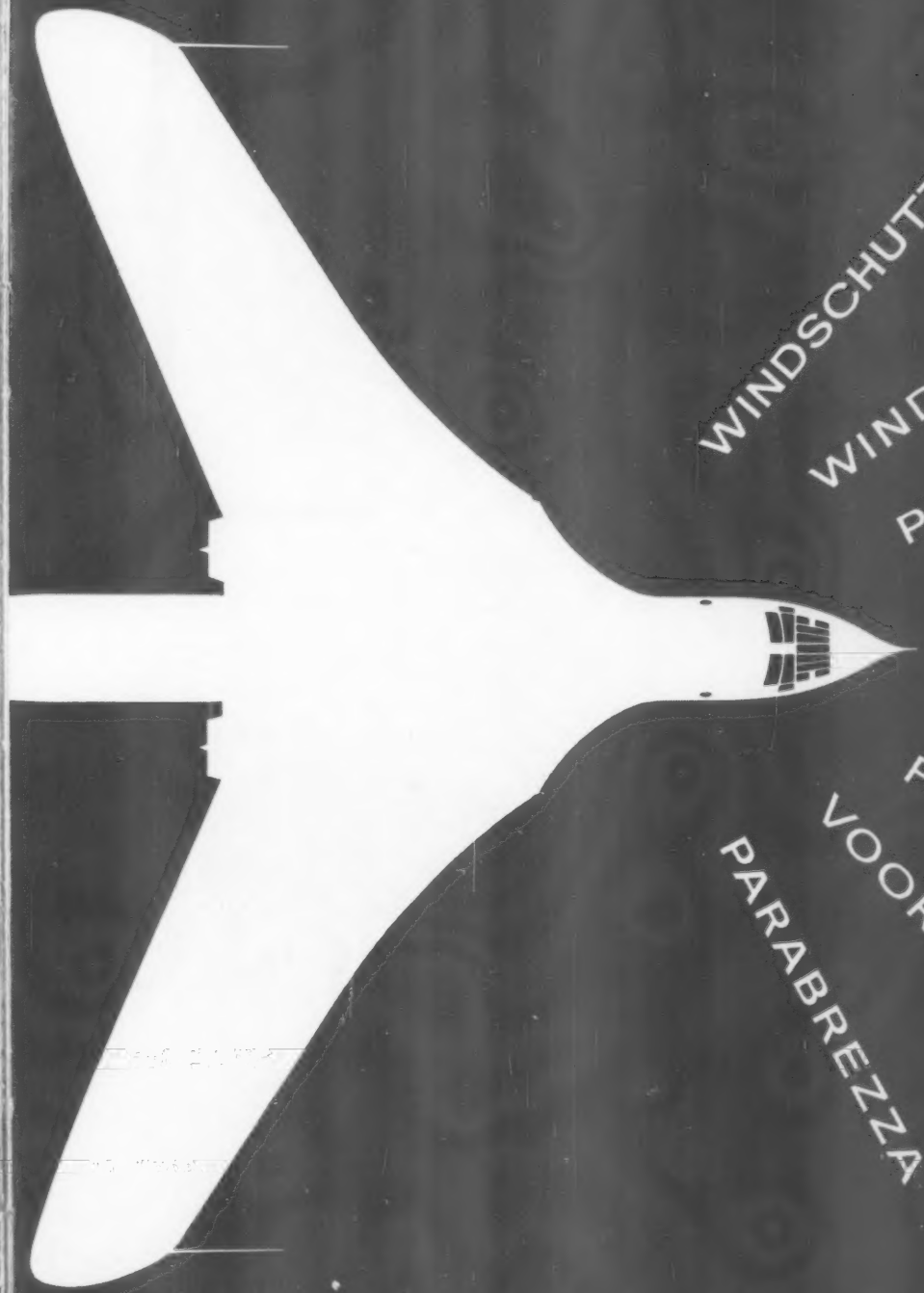
This compound was used for four years before it was finally rejected because the new aircraft demanded a higher degree of aerodynamic cleanliness. B.E.A. is now using the same compound with the gelling agent removed and, coupled with greatly improved access equipment, a very effective clearance system has been developed. Using access equipment developed by B.E.A. a Viscount can be washed clean of light snow or moderate frost in less than 10 min.

The method described gives fairly good results when dealing with frost, light snow and light icing conditions, but for heavy snow or severe icing something better is required. High-velocity hot air shows great promise. The hot-air blast is used in the U.S.A. extensively. But if B.E.A. is forced by weather and aircraft size to adopt snow and ice clearance by air blast, it would be complementary to, and not replace, the fluid and articulated platform unit.

Some aircraft are being equipped with auxiliary power units, usually small gas turbines with compressor tappings. These are suitable for providing air for snow and ice clearance and aircraft designers may soon be asked to provide a suitable plug-in connection for de-icing services.

The future of ground de-icing is beset with even greater difficulties now that high-flying jet aircraft are commonplace. The airframe and especially the fuel tank areas become cold-soaked at high altitude so that even on a hot summer day frost forms on the wing, particularly on the under surface as soon as the aircraft lands. The time taken for the fuel to reach ambient temperature can be anything up to 2 hr. so the chances of giving a pilot a "clean" aircraft in a half or even one hour turnround is fairly remote.

It is desirable for aircraft ice protection systems to be designed so that engine and propeller ice protection systems can be used during taxi-ing and take-off and for the aerofoil systems to be off during this period. The only possible exception is in the case of the rear-engined aircraft, in which case only the part of the mainplane directly ahead of the engines should be protected.



WINDSCHUTZSCHEIBEN

WINDSCREENS

PARABRISAS

TUULILASIT

VINDRUTOR

PARE-BRISE

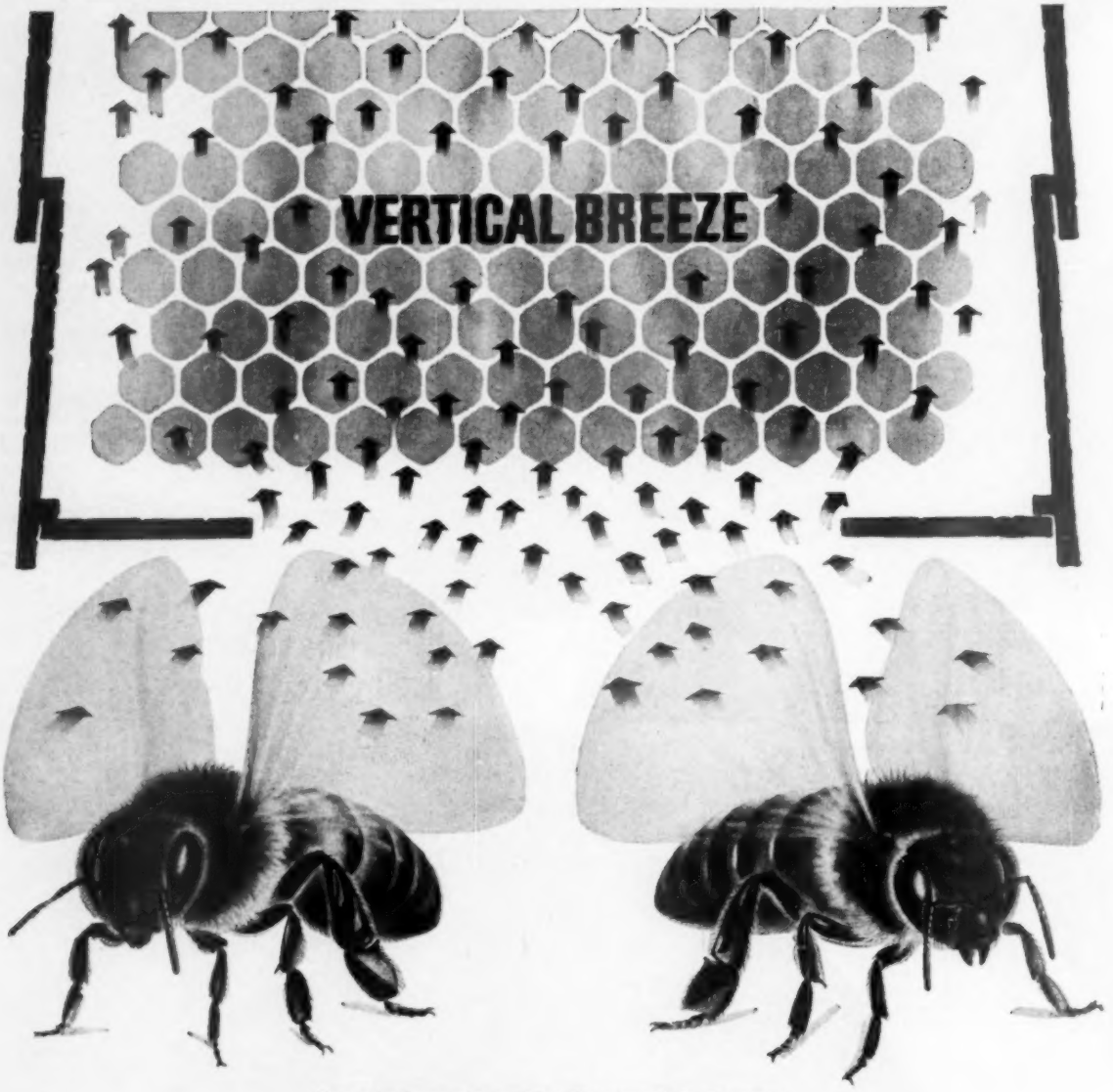
VOORRUITEN

PARABREZZA

by "TripleX"

Regd.

1 ALBEMARLE ST., LONDON W.1.



Honey in the raw is too thin. The viscosity's all wrong.

The bees adjust matters by evaporation, fanning a forced draught up through the combs until in their judgment the product is right for its purpose. Hit-or-miss though the method seems, they achieve an extraordinary accuracy in meeting a self-imposed specification.

What's good enough for bees is one thing: meeting AIR BP specifications is another. A good many years of relentless research, development and performance testing under service conditions have been spent in proving to the hilt that the current range of BP aero lubricants and special products meets every relevant specification in every particular, and with a margin in hand. AIR BP supplies piston and turbine engine oils and a full range of special products to British and American standards as an essential part of a complete service to aviation.

AIR BP

THE AVIATION SERVICE OF BRITISH PETROLEUM

Powerplant Possibilities

NUCLEAR aircraft which could be used as launching platforms for missiles and as military transports were discussed recently at a New York meeting of the Society of Automotive Engineers. Aircraft of this type—albeit conventionally powered—are of particular interest at the present time in the light of the decision taken to adopt the Skybolt air-launched ballistic missile.

Papers read at this meeting discussed the choice of engine type for subsonic nuclear aircraft of this sort, their reliability and work on the shielding of crew compartments. For example, an assessment of types of engine for a multi-purpose nuclear-powered aircraft was given by D. P. Lalor and W. C. Schmill of the Douglas Aircraft Co. The aircraft considered was designed primarily as a military transport, but with minor modifications it could be used for airborne early warning or as a missile carrier or tanker aircraft. Studies were made both for chemical- and nuclear-powered versions to show up basic differences between the types of aircraft.

Parameters affecting the performance of a chemically powered aircraft are its range, lift/drag ratio, cruising speed, specific fuel consumption and weight at the beginning and end of the cruise. These parameters are related by the Breguet range formula.

A comparison between nuclear and conventional aircraft was based on their relative productivity instead of direct operating cost, because of the lack of cost data for nuclear propulsion systems. Productivity was defined as (payload × speed) ÷ (gross weight—payload). It can be regarded as rate of doing work per unit weight investment.

The merits of conventional turboprop, turbofan and turbojet propulsion systems were assessed. Configurations of the aircraft using these three systems were optimized for each speed. All had the same range and payload, but their installed engine airflow and gross take-off weight varied. Each aircraft was taken as flying at its best cruise altitude. Productivities were related to the performance of the most productive aircraft, which was the turboprop.

Maximum productivities for the three engine types were within a few per cent. of each other; but the best productivity for the turboprop was at about Mach 0.6 and for the turbofan and turbojet at about Mach 0.8. In the study the field length was limited to 10,000 ft., which affected the turbojet aircraft more than the turboprop or turbofan.

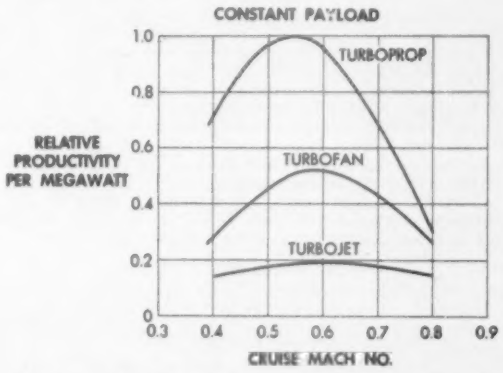
Speed for peak productivity is related to the speed for maximum L/D: for the turboprop it is 10% above this speed and for the turbofan and the turbojet it is 19% above. This study shows that the choice of engine type depends largely on mission requirements. The turbojet provides speed at the expense of take-off performance, the turboprop achieves good take-off performance and slower cruise speeds, and the turbofan gives a reasonable compromise between take-off performance and cruise speeds.

For a nuclear aircraft the parameters affecting productivity include those which apply to the chemical aircraft, with the exception of range and fuel consumption. But others which must be included are reactor type and temperature, crew dose rate, and shielding. Shield weight can be reduced if part of the shielding is at the crew compartment and the remainder at the reactor. The other approach is to have a unit shield with all shielding at the reactor.

To simplify the effect of those parameters, values have been assumed which are suitable for a multi-purpose nuclear aircraft. They call for a unit-shielded reactor with an operating temperature compatible with long life. The crew dose rate assures a crew utilization similar to that for current conventional transports.

The relative productivity for different types of nuclear aircraft was derived by the authors. For a transport mission it gives a good figure of merit for comparison purposes. However, for some rôles, such as remaining airborne with a military load for a long time, productivity may be of secondary importance.

The aircraft considered carried the same payload and crews received the same dose rate. Cruise altitude, take-off distance and reactor temperature were held constant. To maintain the same payload with the different engine types, the reactor power and engine installed airflow were varied.

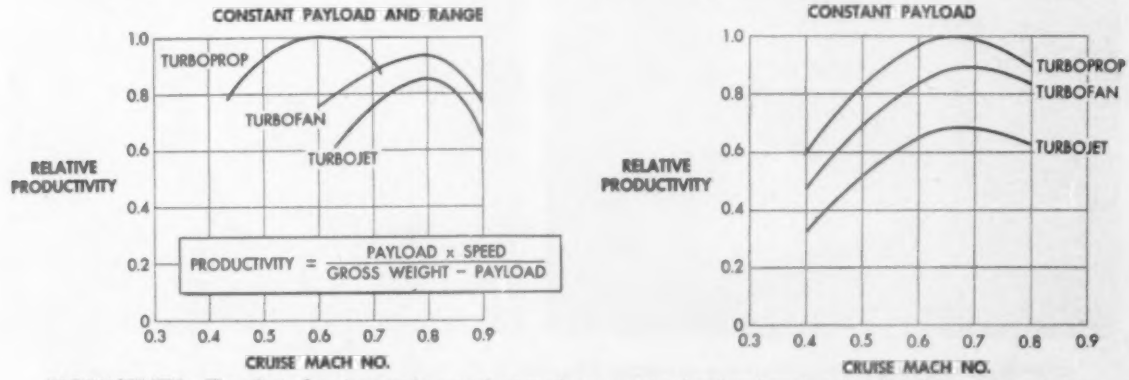


POWER FACTOR.—On the basis of productivity per unit of installed power, the turboprop-powered type is by far the most efficient nuclear aircraft.

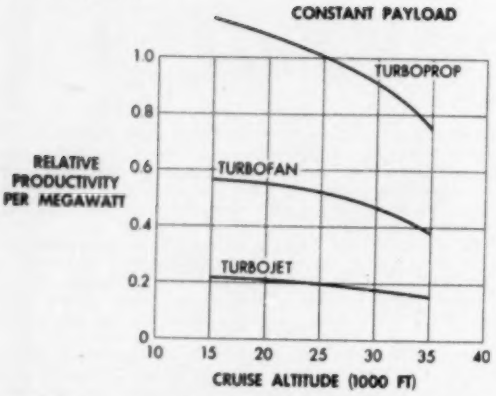
Engines were based on the same basic gas generator and optimized for each flight speed and altitude. The by-pass ratio for the turbofan was varied to give maximum thrust per megawatt and propellers selected for the turboprop to give maximum propulsive efficiency at each design point.

As well as comparing the aircraft on the basis of productivity, their productivity per megawatt was also assessed. This was done because the absolute cost of nuclear powerplants and fuel are open to some doubt, but they can be related to reactor power.

The study showed that maximum productivity for turboprop, turbofan and turbojet nuclear aircraft occurs between Mach 0.65 and 0.70, but that there is a greater spread in productivity than with chemically powered aircraft. The difference is even greater when productivity per megawatt is considered. The turboprop aircraft has approximately twice the maximum value of this



PRODUCTIVITY.—The effect of cruise speed on productivity for conventional and nuclear aircraft (left and right respectively) shows that engine type influences the best speed more for conventional than for nuclear types.



ALTITUDE.—The relative productivity of nuclear aircraft falls off rapidly as cruise altitude is increased.

factor compared with the turbofan and four times the maximum of the turbojet.

Fuel consumption is not a variable for a nuclear aircraft, and thus for all engine types the speed for best productivity approaches the speed for maximum L/D. This is in contrast to the results for chemically fuelled aircraft.

Another difference is the effect of cruise altitude on productivity per megawatt. With chemical aircraft, both s.f.c. and thrust decrease with height and there is an optimum cruising altitude. But with nuclear aircraft the productivity falls off with height. Nuclear aircraft should be designed to operate at the lowest practical altitude; 20,000 ft. to 25,000 ft. would be an acceptable compromise for a multi-purpose aircraft.

Reliability

Flight reliability of nuclear aircraft was discussed by Lionel W. Credit of the Martin Company. The study was based on assessing nuclear systems which would be as reliable as a four-engined chemically powered aircraft.

There are three approaches to achieving flight reliability with nuclear propulsion systems. These are to use a single reactor with redundancy in all systems outside it; to use dual reactors, with redundancy in the systems outside the reactors; and to incorporate alternative chemical-propulsion capability. In studies by Martin a four-engined turboprop aircraft was assumed.

During its development the first nuclear aircraft will inevitably have alternative chemical propulsion. But it is important to differentiate between the operational aircraft which is intended to fly on nuclear power alone and the one which is designed to retain an emergency cruise range on chemical power. This could involve an increase in design gross weight of up to 36%. In addition, the nuclear/chemical aircraft might be handicapped by the additional maintenance required; this could reduce its utilization.

From the design viewpoint, the best aircraft would be all-nuclear with a single reactor. Only the reactor and certain parts of the primary loop would be unduplicated and thus need very high unit reliability; these are relatively simple from a mechanical viewpoint when compared with a chemical engine.

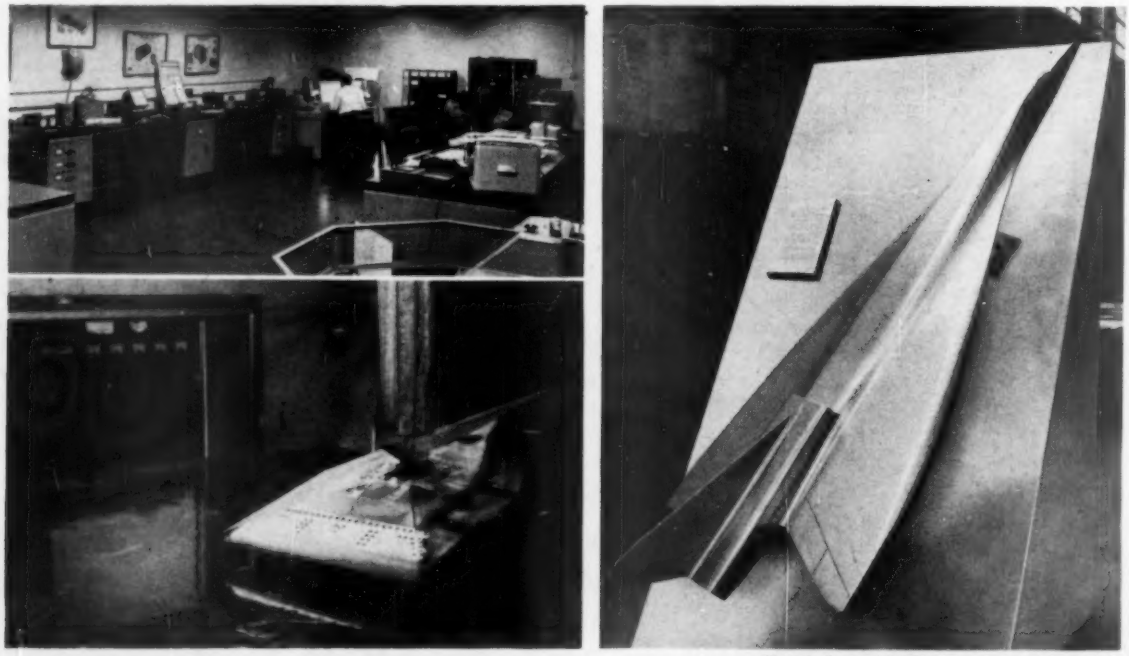
The dual reactor appears to be out of court because of the size of aircraft needed to accommodate the powerplant weight, even if both reactors are optimistically assumed to be in one shield. But if a nuclear-chemical aircraft is chosen with a 1,500-n.m. emergency range on chemical power, its weight is similar to that of the dual-reactor aircraft and it has an inferior growth potential.

Shielding Problems

Practical methods of fabricating radiation shields for nuclear aircraft were discussed by W. Q. Hullings and J. L. McDaniel of Convair. Most of their paper was devoted to techniques used by the company for producing a crew-compartment neutron shield from 6% borated polyethylene.

The first shield programme at Convair culminated in the production of a shielded crew compartment which was installed with a reactor in the Convair NB-36H. Tests showed that the rubber neutron shielding (the only material then available) was inadequate to meet future crew dose-rate requirements. Studies then suggested that borated polyethylene, as a hydrogenous material with boron evenly distributed through it, would be an effective shield from the viewpoint of cost, physical properties, ease of fabrication, radiation danger, stability and shielding capabilities.

As a result of this decision the company has developed techniques for producing neutron shields in this material. For gamma shielding, high-mass materials such as tungsten, lead, iron or depleted uranium are needed. Convair favours lead for gamma shielding; although it has serious shortcomings as a structural material, the company feels that these can be accepted if the gamma shield is securely bonded to and supported by structural members in the airframe.



Photographs copyright "The Aeroplane and Astronautics"

CRANFIELD EXHIBITS.—Among the many interesting things to be seen at the Open Days at the College of Aeronautics recently (see THE AEROPLANE AND ASTRONAUTICS for Jne. 17) were (top left) the new instrumentation laboratory; (lower left) a delta-wing model with jet flap in the 8 ft. x 6 ft. wind-tunnel; and (right) a model of the College's 1960 course design study for a supersonic airliner.

Nuclear Rocket Propulsion

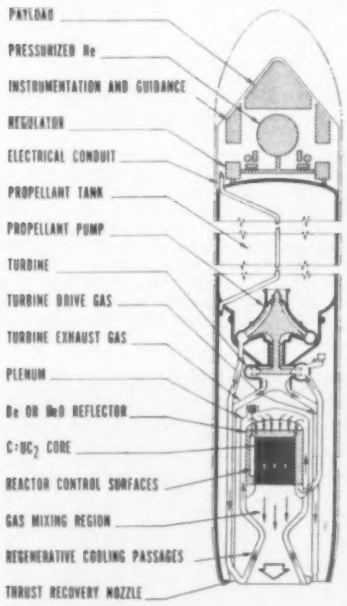
A progress report on the United States experimental programme to develop solid-core nuclear rocket engines

IN the light of experimental work on solid-core nuclear reactors carried out by the U.S. Atomic Energy Commission, the National Aeronautics and Space Administration is expected shortly to place study contracts with several companies for the development of a flight-test nuclear rocket system. Already, design proposals by the Martin company have suggested that the Titan ICBM could be readily adapted as the launching booster with the existing top stage replaced by the nuclear rocket. Similar claims have been made by Convair for the Atlas missile which, however, would retain the standard configuration.

Following sub-orbital tests with Titan or Atlas, Maj.-Gen. D. R. Ostrander has stated, the vehicle could be launched into orbit as an upper stage of the 1.5 million lb. s.t. Saturn booster, possibly in 1965.

Advantage of a nuclear reactor over the conventional chemical rocket system is the higher specific impulse* (600 to 1,500 sec.) offered by the use of working fluids of low-molecular weight. Examples are liquid hydrogen, helium and ammonia.

Fuel elements of the solid-core reactor consist of the fissioning uranium contained in solid material which has a high melting point (i.e., graphite, tungsten, etc.). Propulsion is obtained by pumping the working fluid through, or over, these fuel elements, which is thereby heated for expansion through a conventional-type rocket nozzle.

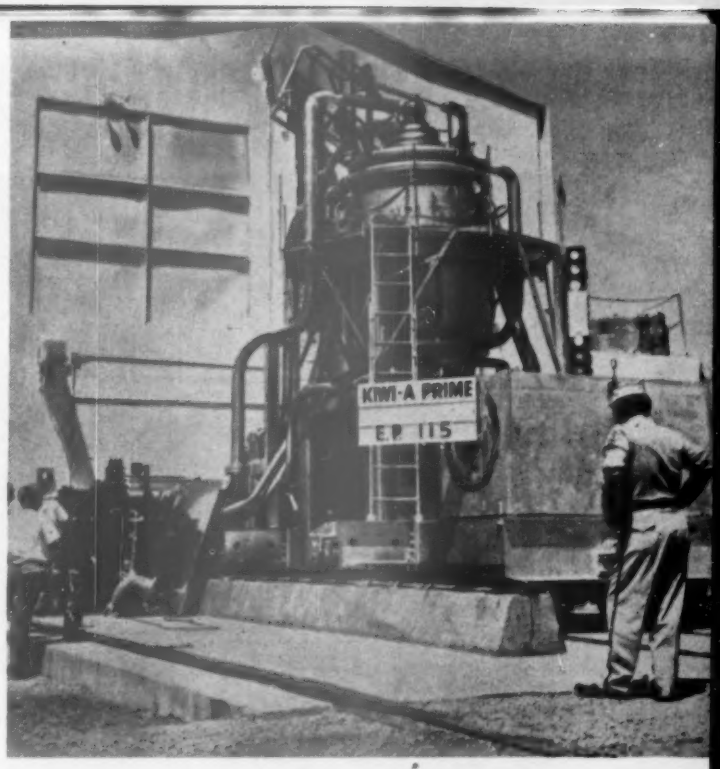


Schematic diagram of a nuclear rocket (Levoy and Newgard). Principal engine components are: Core heat exchanger, comprising fuel elements, neutron moderator and structure; neutron reflector surrounding the core; neutron control rods and operating system; and regeneratively cooled pressure chamber and nozzle.

Initial tests of a solid-core heat-exchange reactor were carried out at the A.E.C. Proving Ground at Jackass Flats, Nevada, last summer. These made use of a static test-device called Kiwi-A (after the flightless bird).

To reduce contamination risks to a minimum, special arrangements were made for the handling of the reactor during assembly and test, much of which is carried out entirely under remote control. The layout of the test area is essentially that of two reinforced concrete buildings separated by 1¼ miles of railway track. One is the mechanical assembly and strip building and the other a test cell where the reactor is actually tested.

* Specific impulse: the amount of thrust which can be produced from each pound of propellent in one second of engine operation.



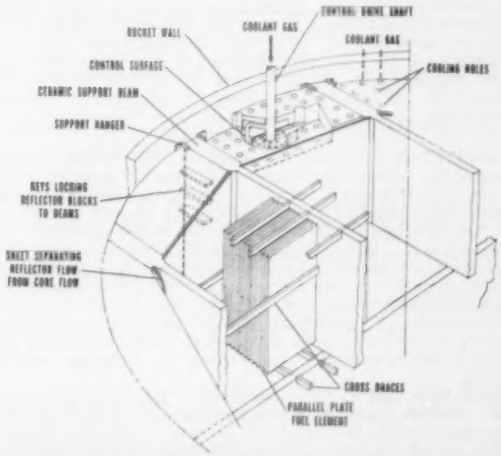
Mock-up of the Kiwi-A Prime nuclear rocket engine seen mounted on a flat-topped railway wagon which also serves as a thrust stand when coupled to the test cell.

Unlike conventional rocket engines, tests of the Kiwi-A are made with the nozzle pointed vertically upward. This greatly simplifies the static firing since large test structures are not required, nor is there any need for exhaust deflectors and water cooling. The 6-ft. tall, 5-ton reactor is, in fact, tested on top of a box-like structure mounted on a large railway wagon.

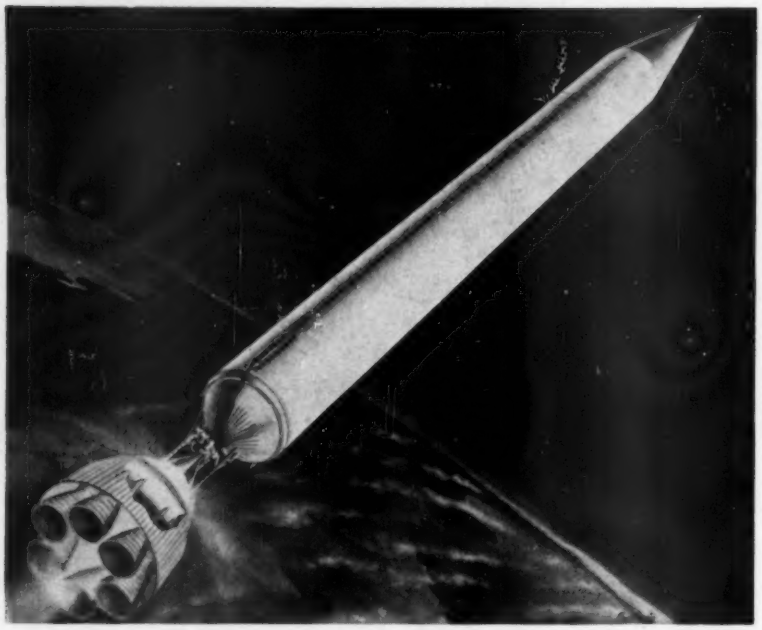
When assembly is complete, the wagon bearing the experimental engine is pushed down the line by a 15-ton remote-controlled locomotive and coupled directly to the test-cell and the necessary control and recording equipment. The box structure on which the reactor stands serves as a junction for the control-rod drive mechanism and the large number of instruments in the test cell.

Also in the test-building area are tanks for water and "working fluid" (gaseous hydrogen was used in early tests), which are pipe-fed direct to the reactor. Water is used for cooling the pressure chamber and nozzle for purposes of test simplicity; later flight-test reactors will have a regenerative cooling system using liquid hydrogen.

To ensure maximum safety for the test personnel, the building from which the test is controlled is situated some two miles from the test-cell. Before starting the reactor, checks are made



Typical reactor core for a nuclear rocket engine with flat plate fuel elements (Levoy and Newgard).



Design for a combined chemical/nuclear rocket system by Krafft A. Ehricke of Convair-Astronautics. Vehicle would have an initial thrust of 2.4 million lb. from a cluster of lox-hydrogen rocket engines arranged around a centrally disposed nuclear engine of 750,000 lb. s.t. operating above 100,000 ft. It could orbit a payload of 230,000 lb. at 300 miles, or soft-land 60,000 lb. on the Moon.

on wind-direction with the help of JATO rockets, which produce black smoke. When wind-direction is right, hydrogen is allowed to flow through the reactor and is lit by a butane igniter.

Regulation of the power level and temperature is obtained by neutron-absorbing rods. When these are slowly withdrawn the fission process begins and the reactor is brought to the desired operating temperature.

Surprisingly, the reactor is unshielded and no attempt is made to prevent the fission products escaping into the atmosphere. The only precaution taken is to ensure that the wind is blowing away from the control station. If the wind should suddenly veer, the two miles which separate the reactor and the human operators are considered adequate protection.

"Spew-out" effects are said to be much less severe than the explosion of a small atomic bomb. Indications are that the maximum fall-out occurs about a mile downwind from the test-cell. An unprotected person at this distance would receive probably less than the maximum permissible weekly dosage for atomic workers.

Nevertheless, radiation checks are an important part of the experiment. Not only are measurements taken at various distances from the reactor but aircraft are deliberately flown through the exhaust plume to obtain instrument readings.

Neither is there any danger that the reactor will "go critical" in the event of some internal damage. The worst that can happen is that the reactor core will melt if temperatures are allowed to get too high.

After a test-run, the reactor is left at the test-cell for several days to "cool down." It is then uncoupled and removed by locomotive to the assembly building at the other end of the track where, from the protection of a shielded bay, it is dismantled for inspection using remote-control handling equipment.

Test Objectives

Preparations are now advanced at the Nevada Proving Ground for testing two further experimental reactors, Kiwi-A Prime and Kiwi-A3. Basically similar to the first nuclear engine, they benefit from the experience already gained from the test programme and will use the same facilities. With Kiwi-A3, it is planned to determine the practical operating life of the reactor and its related systems by running it until damage, in fact, occurs. The objective is to keep a reactor working at a given thrust level for five minutes.

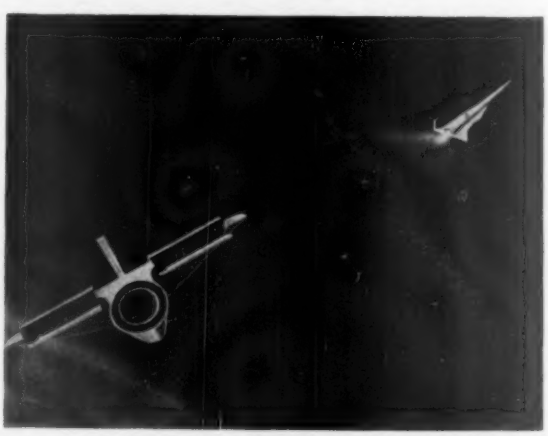
Meanwhile, as a preliminary to this programme, the original Kiwi-A reactor has been reassembled without nuclear components and coupled to the test cell for hydrogen cold-flow testing.

With these further tests completed, it is intended to proceed with reactors more closely resembling the projected Rover flight-test model. It is hoped to achieve a thrust of 50,000 lb., with a specific impulse of between 750 and 800 sec. Eventually, with higher operating temperatures, it is hoped to raise this above 1,000 sec.

However, before these high ideals can be realized, a good deal of further ground testing will be required to raise the reliability of the system, and in particular to maintain the integrity of the reactor core at high flow rates and high temperatures. Early experiments have also taken little or no account of weight, and efforts must now be made to refine the system for flight operations. To assist in this work, a new test cell is being built at the Nevada site to permit more extensive experimental testing of complete nuclear rocket engines.

One estimate suggests that a prototype flight-test reactor will weigh about 10,000 lb. It is unlikely, however, that the total weight of the rocket stage will be less than 50,000 lb. when such items as propellent, structure and sub-systems are taken into account.

When it comes to installing a reactor in an actual rocket structure, additional problems are likely to arise,and, indeed, have already arisen in the design studies various American companies are now making. One such problem concerns the starting-up of a nuclear rocket while it is still attached to the initial stage of the chemical booster. To be effective, the reactor core must be close to operating temperature at the time of cut-off of the boost stage and, to achieve this, propellent flow must be started while the lower stage is still under thrust. This naturally results in hot gas flowing around the chemical booster.—K.W.G.

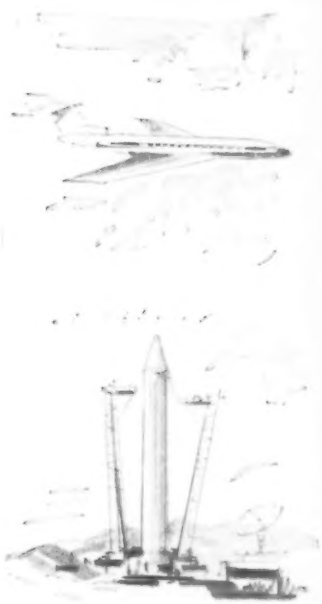


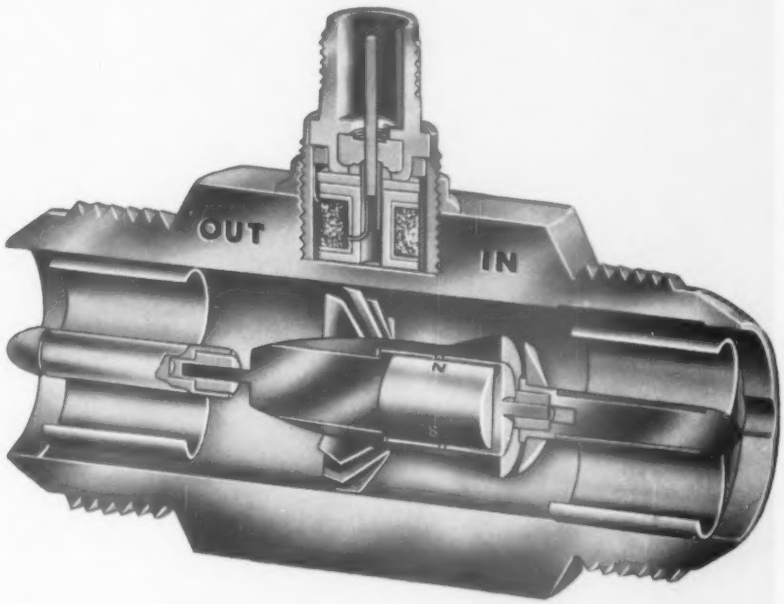
Artist's impression of a two-stage nuclear rocket system for ferrying relief crews and supplies to and from manned satellites, according to Krafft A. Ehricke of Convair-Astronautics. Both stages would be recoverable as aircraft.

Wherever information on fluid flow is required,

the de Havilland POTTERMETER

sets new standards of accuracy and reliability





This new turbine-type flowmeter enables major advances to be made in the techniques of flow measurement and control. The de Havilland Pottermeter is the only flowmeter which offers all these features:

Accuracy to ± 0·1% or better on repetition work, ± 0·5% or better over a 20·1 range. Calibration remains constant for a variety of liquids over wide flow ranges.

Accurately records mass flow.

Contains only one moving part — no thrust bearings — demands a minimum of maintenance.

No larger than the pipeline in which it is installed — may be mounted in any attitude.

Can be supplied with indicating, recording and process control equipment — gives digital presentation of results.

Models available to measure flows from 0·1 to 40,000 Imperial gallons per minute, at a wide range of operating pressures. Larger and smaller sizes made to order.

Can measure flow of any liquid or gas, irrespective of its lubricating or non-lubricating properties, at temperatures ranging from -455°F to 1500°F.

Manufactured as standard in stainless steel — can be made in any non-magnetic material.

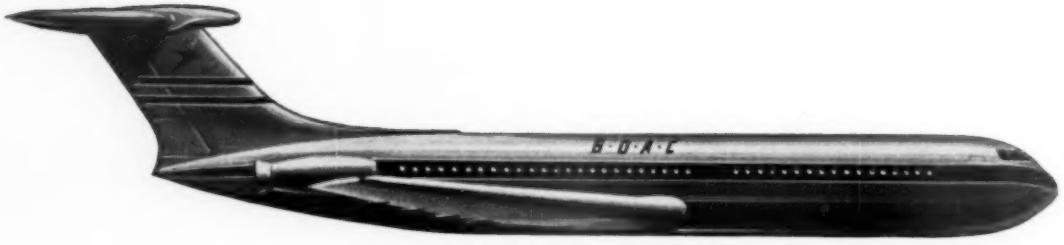
Rapid response rate permits transient flow studies.

Write now for further details to:

DE HAVILLAND PROPELLERS LIMITED

(INDUSTRIAL SALES DIVISION) Hatfield, Herts.

D.H.121 ... designed by de Havilland Aircraft Co. Ltd.



VC10 ... designed by Vickers-Armstrongs (Aircraft) Ltd.

S.C.5-BRITANNIC ... designed by Short Brothers & Harland Ltd.

Dunlop are proud to be associated with the supply of Tyres, Wheels, Brakes and Operating Equipment for this new generation of high-performance British aircraft.

DUNLOP

DUNLOP RUBBER CO LTD AVIATION DIVISION, FOLESHILL COVENTRY

HCD28/AV.

Space Programme Proposals

ONE of the first to express concern over the Government's lack of enthusiasm for a technological programme of aerospace development was the British Interplanetary Society, whose recommendations for a United Kingdom Space Programme were placed before the Prime Minister on Mar. 2. The document outlining these recommendations was drawn up at two special confidential meetings convened by the Society on Jan. 15 and Feb. 19, some time before the cancellation of Blue Streak as a ballistic weapon.

The text of this document has now been released by the Society. It is given below in full.

Recommendations

A British entry into space activity on a more comprehensive scale than has hitherto been proposed has now become essential if we are to maintain our position in World technology. Fortunately, in adaptations of Blue Streak and Black Knight, and in facilities such as Spadeadam and the Anglo-Australian Woomera range, we already have the means—and have already made much of the financial provision—for an early impact in a field which represents a marriage of the best in all the fundamental, and applied, sciences.

The main items of the U.K. Space Programme suggested herewith would be as follow:—

(a) A definite project to develop Blue Streak and a modified Black Knight as a satellite launching vehicle. This would be in addition to the expansion of existing work on satellite tracking and orbit analysis, and a more vigorous prosecution of the project to launch British instruments in the American Scout rockets.

(b) A later project to develop improved and more powerful second and third stages for a modified Blue Streak.

(c) A detailed feasibility study of communications satellites, including an examination of their commercial and military significance.

(d) A gradually developing programme of research on hypersonic winged vehicles and their use for controlled re-entry into the atmosphere.

(e) A modest programme on space medicine, i.e., on the problems of man in space.

(f) A programme of research and development into new propulsion systems, such as the nuclear rocket and electrical (ion and plasma) rockets, possible synthetic metastable propellents of great energy (based on "active" atomic species), etc. This would be a very long-term programme, developing gradually over the next decade or more.

Arguments in support of the above recommendations, and some further details of cost, etc., are given below.

1. There has been an apparent official tendency in the U.K. to consider astronautics purely in terms of the physical experiments (e.g., on the ionosphere or cosmic radiation) which can be performed with high-altitude rockets and close-orbit satellites. This is unduly restrictive in outlook: such subjects are a small, even though important, part of the whole.

To emphasize the above point, which cannot be overstressed, British aviation policy in (say) 1910 could not have been determined merely by considering the influence of the new art on our knowledge of meteorology and surveying.

Of course, as history has shown, the significance of aviation was quite different and much more far-reaching. In much the same way, astronautics has a much broader significance than merely providing a new outlet for research in certain areas of physics.

2. Mankind is obviously on the verge of entering a long new phase of exploration and development, comparable to the conquests of the oceans and the air, but vastly exceeding these in scope. In this context, the views of historians and sociologists on the lessons of the past are as worthy of a hearing as those of contemporary specialists in science and technology.

What will almost certainly turn out to be a complete revolution in human affairs and progress cannot be ignored by this country.

3. It is fully appreciated that the U.K. cannot possibly hope to compete on equal terms of expenditure, and diversity of projects, with the U.S.A. and the U.S.S.R. To assume, however, that we can therefore play no significant part at all would be a betrayal of our national future. The installation of British instruments in American satellites is not, in this context, regarded as constituting, by itself, "a significant part."

Leaving aside the ultimate implications that space exploration will have for the future of mankind, astronautics presents the most severe present challenge to applied science and technology. Any nation that contributes to it in an important way will derive considerable benefits, both from the direct technical standpoint (in terms of general advances in technology), and also in the indirect non-technical sense.

4. Of the relevant non-technical considerations, the one most often mentioned is national prestige.

The less-developed countries of the World will tend in future to judge the leading nations at least partly on the basis of their achievements in space. Such judgments will inevitably be reflected in their purchases of technical equipment of all kinds. Should the belief develop that Great Britain is lagging in this most important branch of technology, our status is likely to be undermined at international conferences when relevant problems come up for discussion.

No one could deny that Russia's success in space has established her as one of the two most advanced countries in science and engineering. Already this has had a marked effect on her position in international trade.

5. Allied to the question of prestige overseas is that of internal morale. This is inseparable from the general sense of national achievement, the stimulus to technology, and the encouragement of new industries with new products.

In future, astronautics will play a rôle, in this respect, equal to, and possibly greater than, that of aviation during the past 50 years.

6. Apart from the above general considerations, there are important and specific military and civil developments of spaceflight which can be foreseen for the fairly near future.

These include the use of satellites for military reconnaissance and possibly bombardment, as early-warning posts, navigational aids, and weather observatories, and, perhaps most important of all, for relaying long-distance radio communications. The strategic and commercial importance of the last-mentioned application, in view of our Commonwealth communications requirements and its associated industry, should need no emphasis. The same might be said of possible future developments in rocket-propelled transport vehicles, capable of reaching the Antipodes within a few hours. On the military side, it might be mentioned that the development of any of these devices by a potential enemy would call for defensive means to be at our disposal.

7. It is believed that a truly significant British contribution could be made for an annual expenditure rising within five years to about £20,000,000, and being maintained thereafter at this approximate level. The corresponding deployment of technical manpower would rise to about 1,000 graduate scientists and engineers (drawn from a wide variety of disciplines), with supporting technicians, industrial labour, and facilities. This would satisfy the requirements of the programme outlined at the beginning of this memorandum.

These figures assume the continuance of relevant effort on aircraft and missile (especially ballistic missile) defence projects. If these were curtailed, the budgets specifically for space would need to be greater—as, in that event, they presumably could be. In this connection, it is suggested that a very important consideration is the fact that astronautical projects would enable national techniques and skills to be maintained against the possibility of any unfortunate future need to reverse disarmament policies.

Conclusion

It is respectfully submitted that an early statement of Government policy, along the lines here advocated, should be made. This should courageously state the long-term objectives, and guarantee reasonable continuity in the effort involved: without the last proviso, workers of an adequate calibre will not be attracted into it.

It is thought that much of the World, especially the Commonwealth and Europe, is awaiting such a lead from us.

If some such pronouncement is not made soon, there is a grave danger of contributing still further to the growing tendency for British research and development in the fields of applied science and technology to be associated almost entirely with objectives of immediate military, commercial, and economic importance. If this state of affairs obtains, then the achievements of our scientists and engineers will become as limited as their objectives, and eventually there will be an inevitable decline in both the level of British applied science and technology and in the morale of the people involved.

The prevention of such a decline can be accomplished if, and only if, a reasonable proportion of our technical effort is expended in areas of a long-term and adventurous nature, one of the most promising of which would be astronautics.

Satellite Communications

INCREASING enthusiasm for artificial satellites as repeater stations for global communications has been shown in Britain recently and is likely to be a primary consideration in any future U.K. activities in space-technology. An enthusiastic supporter of the communications satellite is Mr. J. R. Brinkley, managing director of Pye Telecommunications, Ltd., who spoke on the subject at the recent Commonwealth Press Union Conference.

Commenting on the World shortage of short-wave radio and underwater cable circuits, he said that more submarine cables would not solve the problem. The only practical medium for the future was communication via space-satellites.

Giving the Moon-relay experiments conducted with the Jodrell Bank radio telescope as an example of what can be achieved in a short time with reasonably modest equipment, he said he had heard the signals returning from the Moon improve in the short span of 18 months from an unintelligible noise to quite good intelligibility. During this period, he said, we have made the first attempts to analyse the band-width of the Moon, with a good deal of success.

As a result of these experiments, Mr. Brinkley said he was "in no doubt that practical circuits via the Moon are feasible now, and will, in the space of a few years, become economic. Quite recently, the United States Navy established a permanent Moon circuit between Maryland and Hawaii. It carries four simultaneous teleprinter channels and is also capable of excellent picture transmission.

"The circuit is said to have a high degree of reliability and is open for six hours a day. It is free from fading and impervious to magnetic storms and sunspots."

However, Moon circuits have certain inherent disadvantages, continued Mr. Brinkley. There was a particular problem in the variation which occurs in the times when the circuits were open and closed during the lunar month. The great advantage of the Moon as a reflector for radio signals is the vast number of channels that could be made available.

The really big opportunities for space communication, however, lay in transmission via artificial satellites. A large number of big inflatable satellites in fairly close orbits might take the place of the Moon for the passive reflection of radio waves. In company with active space-borne repeater stations, they offer the prospect of hundreds of high-quality telephone and television circuits in operation 24 hours a day.

"Such satellites," Mr. Brinkley said, "will bring undreamed-of improvements in World-wide communications. If necessary, a million circuits could be provided, some of them like private wires; newspapers could have a permanent circuit open every day of the week with all countries of the World.

Reverting to the work of Pye Telecommunications, Mr. Brinkley said that a design study had shown that an experimental active relay satellite was practical now for this country. The Pye scheme required only a single valve. The satellite itself would be powered by solar cells and have an operating life of one to two years. It would weigh about 100 lb. and could easily be placed in orbit by a suitably modified Blue Streak missile.

"If we are to play our traditional part in the telecommunications expansion that lies ahead, it is necessary that we learn the art of satellite launching," concluded Mr. Brinkley. "The establishment and control of these space circuits will be in the hands of those countries competent in the art."

In Orbit

TO keep readers up to date with the number of satellites and space-probes at present in orbit, we publish below a list of the vehicles concerned. It has been prepared by the National Aeronautics and Space Administration and is correct to Jne. 3. It gives respectively the satellite or probe's name; country of origin; launch date; and whether transmitting.

Explorer I (U.S.A.); Jan. 31, 1958; no. Vanguard I (U.S.A.); Mar. 17, 1958; yes. Lunik I (U.S.S.R.)*; Jan. 2, 1959; no. Vanguard II (U.S.A.); Feb. 17, 1959; no. Pioneer IV (U.S.A.)*; Mar. 3, 1959; no. Explorer VI (U.S.A.); Aug. 7, 1959; no. Vanguard III (U.S.A.); Sept. 18, 1959; no. Lunik III (U.S.S.R.); Oct. 4, 1959; no. Explorer VII (U.S.A.); Oct. 13, 1959; yes. Pioneer V (U.S.A.)*; Mar. 11, 1960; yes. Tiros I (U.S.A.); Apr. 1, 1960; yes. Transit IB (U.S.A.); Apr. 13, 1960; yes. Spacecraft (U.S.S.R.); May 15, 1960; yes. Midas II (U.S.A.); May 24, 1960; yes.

In this list * denotes space vehicles orbiting the Sun. There is a possibility that Lunik III, the Soviet "automatic interplanetary station" which photographed the hidden side of the Moon, has re-entered the Earth's atmosphere unobserved. Russian scientists had predicted this would occur last April.

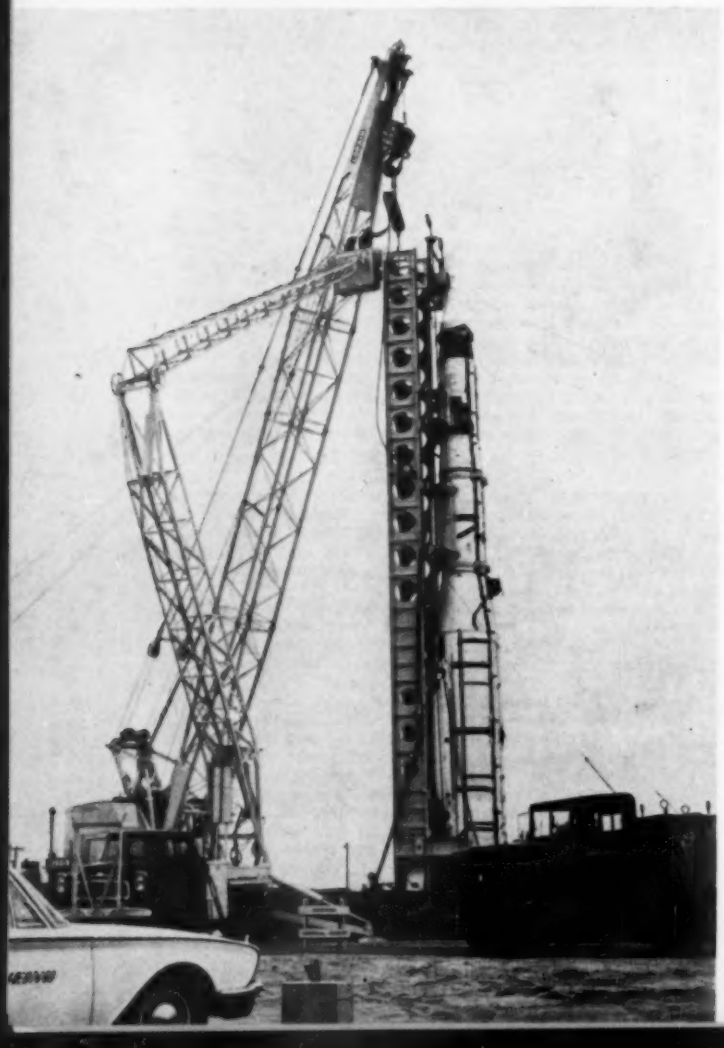
Experimental Ion Engine

A YEAR-LONG programme to design, develop and laboratory-test an experimental ion low-thrust rocket engine is being undertaken by Hughes Aircraft Co., under contract from NASA. Initial aim is to produce a bench-test unit developing a thrust of only about 1/100 lb. If this is successful, further engines will be built to deliver higher—but still micro-g—thrusts.

Principle of ion-drive is that of passing a stream of alkali metal atoms (e.g., cesium) through a hot tungsten electrode. This pulls electrons away from the atoms, creating what physicists call positively charged ions. The ion stream is accelerated and focused by several more electrodes and finally, other electrons are mixed with the ion stream so that a neutrally charged beam of particles emerges from the engine. There is no "exhaust" nozzle.

The ion stream reaches a speed of more than 100,000 m.p.h. in the space of a few inches. Although the ion engine itself measures only about 8 in. long and 4 in. in diameter, it requires a nuclear auxiliary power source to operate effectively outside the test laboratory. Work to this end is proceeding under the auspices of the U.S. Atomic Energy Commission as a development of the SNAP-8 nuclear generator.

Needless to say, ion-drive cannot be used in propelling space-vehicles from the Earth's surface because of their inherently low thrust. They will, however, become effective when operated in space because, unlike the conventional chemical rocket, they can theoretically operate for days and weeks on end to build up suitably high terminal velocities.



A test-vehicle for the Boeing SM-80 Minuteman ICBM is lowered into a launching "silo" at Edwards Air Force Base for a tethered test-firing. An illustrated review of the test programme was given in our issue of last week.

Commercial Aviation Affairs

(*Continued from page 759*)

FIRST 720 SERVICE. — United Air Lines will operate the first service with Boeing 720s on Jly. 5 between Los Angeles, Denver and Chicago. United has 18 720s on order, 11 for delivery this year.

ELAND-CONVAIR SALE.—Butler Aviation of Chicago has ordered a Napier Eland-powered Convair 540 for delivery in September. It is to be used for long-haul executive transport operations.

APRIL HIGH. — There was a 29% increase in U.K. air transport movements in April, 1960, by comparison with the same month of 1959. Passenger numbers increased by 43% and freight tonnage by 46%. The three figures were 31,046 movements, 786,642 passengers and 22,861 short tons respectively. Passenger traffic trebled at Southend and Leeds/Bradford Airports.

707 STATISTICS.—By the end of last month 120 Boeing 707s and 720s had been delivered and 114 were in service with 12 airlines. The combined fleets had carried 5,119,000 revenue passengers. During 1959 Pan American's average load factor with 707s was 88.2%.

FAR EAST ELECTRAS.—K.L.M. introduced Electras on the Amsterdam-Singapore and Bangkok/Saigon services on Jne. 6. At the time of writing K.L.M. had received 10 of its 12 long-haul Electras on order.

A.T.C. STRESS.—Volunteers from among the F.A.A.'s 17,000 A.T.C. and communications staff will take part in an extensive "environmental stress" study, the results of which will be used to provide a basis for establishing, as necessary, revised rules and conditions of work.

MORE DOPPLERS.—South African Airways has ordered Canadian Marconi Doppler sensor and computor units for its Boeing 707-320s, and Irish International Airlines has ordered C.M.C. computors for use in conjunction with the sensors already being supplied for installation in its fleet of three Boeing 720s.

A.N.O. 1960.—Among the provisions in the revised Air Navigation Order, 1960, is one which extends the flight-crew rest and duty period rulings to all operations, whether or not the aircraft is actually engaged in public transport; only flying clubs and schools are excluded. Another new provision is to the effect that all aircraft flying for public transport and instructional purposes must use licensed aerodromes; exceptions are club gliders, aircraft with all-up weights of less than 6,000 lb. flying on non-scheduled services, and helicopters on non-scheduled services.

SUPER WIDGEON.—Gannet Aircraft of Sun Valley, California, have purchased 24 Grumman Widgeons for conversion into six-seat executive transports. Known as Super Widgeons, they have 300 h.p. Lycoming R-680 powerplants, new landing gear, instrumentation and controls.

GUERNSEY RUNWAY.—Work on more than 3,800 ft. of the 10/28 runway at Guernsey has now been completed and the temporary grass strip has been abandoned. The ultimate length of the runway will be 4,800 ft.

MORE 880s FOR DELTA.—Three additional Convair 880s have been ordered by Delta Air Lines for delivery in August and September, 1961. Ten 880s are already on order by Delta, or delivered, and all-first-class services were started on May 15.

MORE CONWAY SERVICES.—On Jne. 2 Alitalia operated its first Rome-London-New York service with a Conway-engined DC-8 Series 40. By August, all Alitalia transatlantic services will be operated by DC-8s, with 24/100 seating configuration. As already reported, T.C.A. inaugurated its Conway DC-8 service between Montreal and London via Prestwick on Jne. 1; configuration is 28/99. On Jne. 14 Varig was expected to become the fourth operator of Conway-engined Boeing 707-420s, with three services a week between New York and Brasilia, the new capital city. Seating configuration of these aircraft is 64/45.

ORDER BOOK.—*Esso Air World* has published a new tabulation of turbine-powered civil transport aircraft on order by, or in service with, the World's airlines at May 15, 1960.

BACK TO JORDAN. — B.O.A.C. reopened its London-Amman service on Jne. 3 after a lapse of nearly four years. The Jordan capital is now on the Britannia service to Bahrein which calls also at Rome and Kuwait.

AUA PROGRESS.—Austrian Airlines carried 76,964 passengers in its second year of operation—more than twice the figure for the inaugural 12 months. The carrier now has six Viscount 837s and operates over 19 routes. The managing directors (since Jan. 1, 1960) are Felix Schalk (commercial) and Dipl. Ing. Ferdinand Brandner (technical).

HELICOPTER SERVICE. — A scheduled helicopter service is now operating between Lugano (Switzerland), Malpensa Airport and Milan (via Restelli heliport). Three round trips a day are flown.

B.O.A.C. IN IBERIA.—Sales offices are being opened by B.O.A.C. in Madrid (Jly. 14) and Lisbon (Aug. 1) following the reintroduction of the Corporation's South Atlantic services.

ALASKAN ACCIDENT.—A Pacific Northern Airlines' L-749, on a flight from Cordova to Anchorage, struck the top of Mt. Gannett (9,620 ft.) on Jne 14. The crew of five and nine passengers were killed.

News About People

A.A. APPOINTMENT.—Mr. Paul R. Hildebrandt has been appointed general representative in the U.K. for Aerolineas Argentinas in succession to Mr. A. W. Robertson, who had returned to the head office in Buenos Aires. Mr. Hildebrandt was formerly A.A.'s general representative in Western Germany.

ALUMINIUM NEWS.—General Sir Geoffrey Bourne, K.C.B., K.B.E., C.M.G., has been appointed director-general of the Aluminium Development Association. He succeeds Air Cdre. W. Helmore, C.B.E., who recently retired after 14 years as director-general of the Association.

ASSOCIATED ENGINEERING. — Mr. C. D. Carmichael has been appointed chief engineer of the engine components division of Associated Engineering, Ltd. He was previously assistant chief engineer of D. Napier and Son, Ltd.

FERODO APPOINTMENT.—Mr. P. Blanford recently relinquished his post as general service manager at Vickers-Armstrongs (Aircraft), Ltd., and joined the management of Ferodo, Ltd., at Chapel-en-le-Frith, Derbyshire.

MET. AWARDS. — This year's Meteorological Office awards for outstanding service in providing weather reports go to Capts. G. P. Lace and D. F. Redrup of B.O.A.C. Brief-cases will be presented to them at the GAPAN headquarters on June 28. Awards of books, for the best series of reports, will go to Capts. R. H. Rose and R. H. Payne (B.E.A.); Capts. I. R. Stephens, A. V. Rix and G. R. Buxton (B.O.A.C.); and Navigating Officers R. C. Langdon, G. F. Andrews, C. H. Bancroft, B. L. Baldwin, C. H. Ball, J. Ellington, E. E. Freeth, D. Kaye, H. F. Musker and R. L. Yorke (all of B.O.A.C.).

J. M. TWISS.—We regret to record the death on Jne. 12, following a major operation, of Mr. J. M. Twiss, one of the general managers of Skyways. He has been associated with Mr. Eric Rylands for 26 years and has played a prominent part in the development and working of the group of companies directed by Mr. Rylands.

Britain's Second Air-cushion Rider

DURING the past week or so, the Britten-Norman Cushioncraft has been doing some initial "flying" at the company's airfield at Bembridge, Isle of Wight. These preliminaries have, it seems, proved sufficiently promising for the craft's first public demonstration to be scheduled and this should have taken place by the time these words are read.

In point of fact this machine is a particularly interesting approach to the problem of providing a small utility—and comparatively cheap—air-cushion vehicle for use in underdeveloped areas. The object has been to develop a prototype which in a production form would immediately have a market. The present craft has been built for Elders and Fyffes for use in studying the potential value of such a vehicle in carrying bananas from plantations in the Southern Cameroons.

It is interesting to note that before work was finally started, a market survey indicated that there was considerable scope for an exploratory air-cushion vehicle, provided that it cost no more than £10,000. Industrial companies and corporations were found to be prepared to buy such a machine in order to gain field experience with a vehicle of this type so as to be able to decide and specify the optimum craft for their particular requirement.

After a good deal of investigation of the overall problem and several design studies, Britten-Norman came to the conclusion that the minimum practical size for their first Cushioncraft would be represented by a cushion-area of around 200 sq. ft. and an empty weight in the region of a ton. The team reckoned that in production, the specific costs in terms of basic weight would not be more than that of a "simple light aircraft"—somewhere around £2 per lb. In really large production runs, the cost would, it is thought, be nearer that of motor transport vehicles, namely between 10s. and £1 per lb.

The Britten-Norman Cushioncraft in its present form has a number of most interesting features. Perhaps the most surprising is that the main structure is wooden—chosen presumably on the score of weight and production cost. It follows normal wooden airframe structure practice with spruce members and a plywood skin.

In its basic principles the Cushioncraft follows other similar devices in having a power-driven fan ejecting air downwards, underneath the craft, through a peripheral nozzle system. In this case, however, the fan rotor itself is of the peripheral type in order to minimize the duct losses, which can be considerable in the case of a centrally disposed fan with lengthy feed ducts to the periphery. One might expect, however, some of this advantage at least to be outweighed by the greater gyroscopic effect of a large-diameter rotor. Moreover a certain amount of power must be "lost" in torque reaction.

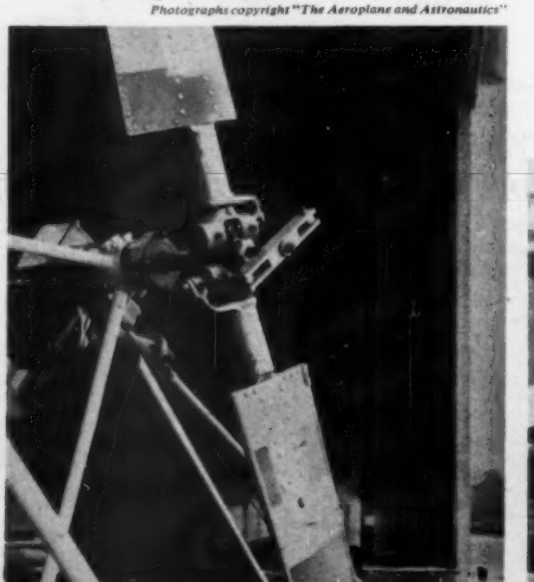
The method of driving the rotor is an ingenious combination of automobile engine and friction wheel drive. The power unit is in fact a 170-b.h.p. Coventry Climax engine on a three-point mounting behind the cabin. This drives, through an orthodox shaft and gearbox system with a two-plate hydraulically operated clutch, a tyred automobile wheel bearing on the inner rim of the rotor.

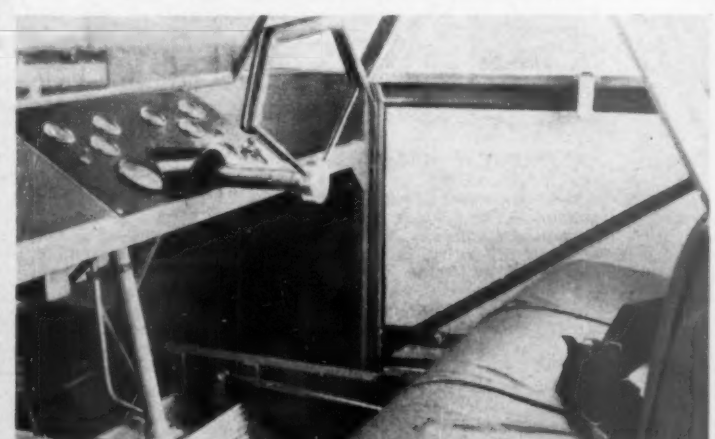
Between the rotor's inner and outer shroud rings which form a shallow vertical duct are 40 radially disposed aerofoil-section laminated-wood blades. Below the rotor a single-ring efflux duct, 10 in. wide at the exit, directs the air from the rotor towards the centre of the craft to aid stability and minimize the "spillage" effects. The outer wall of this efflux duct is made of 24 s.w.g. Birmabright with a Fibreglass top fairing, while the inner wall is of 24 s.w.g. light alloy.

The rotor is carried on a series of rollers and constructed

Below, left, a close-up of one of the two Hiller helicopter tail rotors used to provide forward thrust, torque reaction and directional control. Below, right, simplicity is the keynote of the Cushioncraft's controls; the cabin can accommodate two passengers in addition to the "pilot."

Photographs copyright "The Aeroplane and Astronautics"





of laminated wood covered with sheet plastics material. Stator blades for the rotor are also of laminated wood, but have a covering of doped fabric.

For forward propulsion, two Hiller helicopter tail rotors are mounted towards the rear of the craft on outward-sloping pylons. These rotors are driven by shafts from the main rotor drive through an auxiliary gearbox. Their pitch is altered collectively to give the required forward—or backward—thrust, and differentially for direction control of the Cushioncraft.

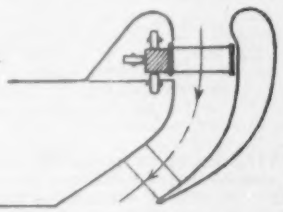
In the cabin the "pilot" has two main controls. A combined hand throttle and clutch operates the engine and main rotor r.p.m.—thus controlling the hovering clearance. A steering wheel with fore and aft movement operates the Hiller tail rotors to give collective and differential pitch changes for controlling forward speed and direction of movement. Pushing the wheel gives forward propulsion; pulling it back reverses the direction of the craft. All the controls are operated by rods and cables.

To enable the Cushioncraft to be pushed about on the ground when the engine is not running, there are three pairs of castoring wheels with pneumatic tyres mounted under the main body. These wheels can be jacked up to raise the whole craft in order to facilitate ground servicing.

Overall, the Cushioncraft, which is circular in planform, has a diameter of 18 ft. 10 in. and a height of 8 ft. It has accommodation for two passengers in the cabin and is designed to lift a total disposable load of a ton; its empty weight is quoted as 2,240 lb. No performance figures have been established as yet, but its top speed is expected to be in the region of 40 m.p.h.; two 15-gal. light-alloy fuel tanks give the craft a 6-hr. endurance. Operational hovering height is estimated to be 12-15 in. above the ground or water.

KEY

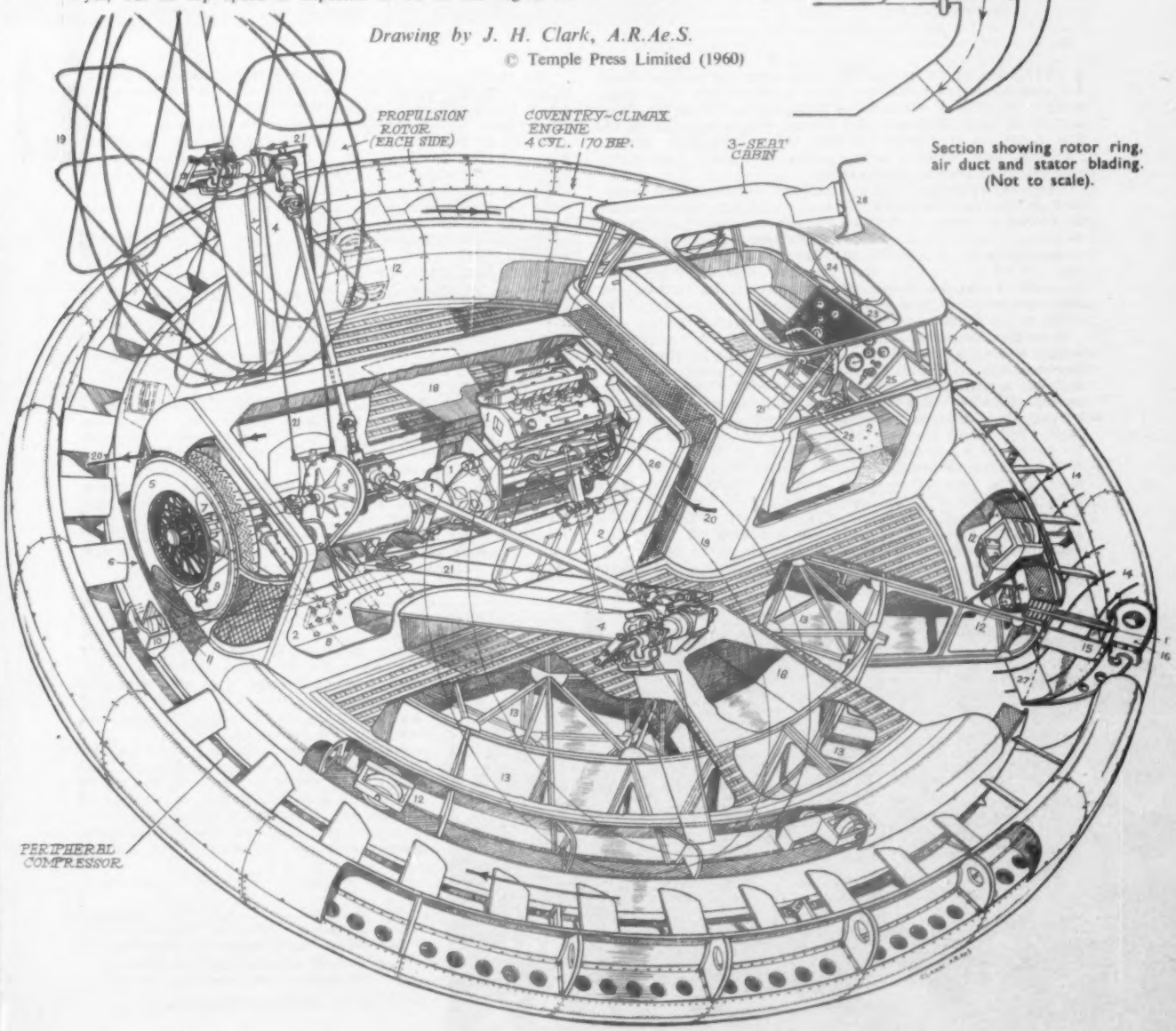
1. Engine clutch and gearbox unit mounted on bearers 2 running right across the "raft" disc.
3. Secondary gearbox distributes power to two outboard rotors 4 and via motorcar wheel 5, to drive rotor ring 6.
7. Wheel mounting hinged at 8, with adjustable tensioner 9 to set correct "road-pressure" on ring 6.
10. Underset rollers take thrust of "road-pressure" on ring 6.
11. Fabric surfacing for grip.
12. Top, back and underside support-rollers (six units around the periphery).
13. Box-structure raft with wood frames and plywood skin metal-faced on underside.
14. Air passes through rotor and is compressed to give lift "cushion."
15. Support arms to outer fairing 16.
17. Outer shroud attached to blades via through-bolts which connect with laminated rotor ring 6.
18. Fuel tank space (each side).
19. Line of proposed propulsion-rotor guard.
20. Cooling air through engine radiator and out at rear.
21. Pilot's controls (push-pull for collective pitch change of propulsion rotors, rotate for differential pitch change).
22. Throttle and clutch.
23. Instrument panel comprising fuel, oil-pressure, oil-temperature and water-temperature gauges, ammeter, fuel-pump switch, window clear-vision switch, airspeed indicator, r.p.m. counter, starter, ignition switch.
24. Clear-vision disc.
25. Accumulator.
26. Line of oil tank.
27. Stator blading.
28. Pitot mast and pennant.



Section showing rotor ring, air duct and stator blading. (Not to scale).

Drawing by J. H. Clark, A.R.Ae.S.

© Temple Press Limited (1960)



Flying the Bellanca 260

by

John Fricker

LITTLE known compared with many other types of American light aircraft, the Bellanca 260 is a new version of a vintage design. In its basic form it first appeared in 1937 as the three-seat 75/90-b.h.p. Bellanca 14-9 Junior, which was one of the first American cantilever low-wing cabin lightplanes, and its steel-tube and wooden airframe has undergone only minor changes to its present configuration.

From the original 75-b.h.p. Le Blond radial-engined Junior, with its fixed tailwheel undercarriage, the design was developed by Giuseppe Bellanca through the Cruisair and Cruisemaster to take a remarkable range of progressively bigger powerplants, including the 90-b.h.p. Le Blond, 100-b.h.p. Lycoming, 120-b.h.p. and 150-b.h.p. Franklin and the 190- and 230-b.h.p. Continental. From the 90-h.p. version onward, the landing gear became retractable, and end-plate fins were later added to the tailplane to maintain stability with the increased power.

Immediate predecessor of the current Model 260 was the 230-b.h.p. 14-19-2 Cruisemaster, which had been developed by Downer Aircraft Industries Inc., Minnesota, acquirers of the Bellanca assets. Subsequent installation of the 260-b.h.p. Continental IO-470-F flat-six, fuel-injection engine, a retractable tricycle undercarriage and other refinements resulted in the Model 260, which first flew on Dec. 5, 1958, and was followed by the initial production aircraft on Feb. 23, 1959.

Construction of the Cruisemaster ceased after 104 had been built by the Downer company, and the Model 260 is being built at the rate of 12 per month. Its appeal became obvious during the recent Shackleton sales week-end, when we were able to inspect and fly a Model 260 at Kidlington. An Irish-registered example, EI-AKR, was brought there by Mr. T. Wayman-Hales, although U.K. sales are being handled by Peter Clifford at Kidlington.

The predominant initial impression of the Bellanca 260 is undoubtedly the superb finish of its Bellanca "B" section wing, which has a glass-like surface with virtually no deformation or wrinkles to mar the perfection of its contours. This is achieved by covering the entire Sitka spruce and mahogany wing, ailerons and flaps with a glass-fibre skin, after pressure sealing in a plastic bath, and a similar covering is used for the steel tube fuselage and tail assembly. Glass-fibre is also used for engine cowling and spinner, with consequent resistance to fatigue cracks.

After such a superlatively sleek wing, it is odd to find a wire-braced tailplane and fin on the Bellanca 260, although a further reminder of the 1937 origin of this 1960 aeroplane is provided by the square-section fuselage. Despite these anachronisms, the combination of 260 b.h.p. in an airframe which started life with 75 b.h.p., and a really laminar-flow wing has resulted in a startling performance. The 260 has a maximum cruising speed of more than 200 m.p.h., climbs at nearly 2,000 ft./min., and is gloriously over-powered, which is a very rare virtue.

Oddly enough, the handling does not seem to have suffered from the big "stretch" in the design, and in many respects the Bellanca is above average for an American type. Its cabin furnishings are perhaps slightly less luxurious than is usual across the Atlantic and one gets the impression that the space available for the four occupants is rather smaller. Accommodation is comfortable, however, and entry through the single moulded car-type door via the starboard wing root is quite straightforward. The Bellanca sits low on its tricycle undercarriage, which retracts hydraulically fore and aft to leave half the wheel diameters exposed for belly landing protection.

The cabin has two large single windows on each side for excellent azimuth visibility, and curtains installed to starboard in EI-AKR gave it a homely aspect. Forward view through the steeply raked windscreen is less good, being obstructed by the deep instrument panel, thick front frame and steel tube structural members. The front seats (glass-fibre again) are located on the main spar pick-ups, and are adjustable for leg length.

I quite liked the Bellanca "colour-coded" instrument panel, which has different light background shades for the flight and engine instrument groups, although disposition of the former equipment is rather haphazard. The fuel pressure and manifold pressure gauges and the tachometer are situated

The flight and engine instruments of the Bellanca are on differently shaded panel sections for rapid reference. The ram's-horn control wheels require a relatively small rotation for full aileron travel.

Photographs copyright "The Aeroplane and Astronautics"

directly above their respective controls for mixture, throttle and pitch, the outer plungers incorporating vernier-twist adjustment. The fuel pressure gauge was similar to that encountered in the Cessna 210 and, in addition to giving an absolute pressure reading in p.s.i., is graduated for altitude at take-off and percentage power for cruise.

Fuel system of the Bellanca normally comprises two wing tanks each of only 16.6 Imp. gal., so the optional auxiliary tank of a similar capacity in the fuselage, bringing the total to 50 gal., is almost essential. It was installed in EI-AKR, which Mr. Wayman-Hales said he had flown up to 1,010 miles non-stop.

When full, the auxiliary tank does not permit baggage to be carried with four adults on board, within the 2,700 lb. gross weight. Normal maximum baggage capacity is 186 lb., and the rear fuselage compartment is accessible through an outside door, or from inside the cabin.

Fuel and engine gauges are grouped in a compact presentation below the small ram's-horn control wheel on the port side, by which they are slightly obscured. Ample room remains on the front panel for radio and navigation equipment, which in EI-AKR, comprised a Narco Omnigator, a Narco Mk. V transceiver and a Lear ADF-12E radio compass. The Bellanca has an accessible panel of circuit-breakers on the port cockpit wall, matched on the opposite side by a flap position gauge. Control levers for the hydraulic flaps and undercarriage are between the front seats, alongside the fuel selector, which also operates the appropriate gauge.

After starting, the Bellanca taxies easily via the steerable nosewheel, and the toe brakes on the port rudder pedals bring the Goodrich hydraulic disc brakes into effective operation. The oleos felt fairly hard on Kidlington's grass, although the large-diameter undercarriage wheels, which are all of equal size, and the longish wheel base, prevented undue pitching.

With roof-mounted elevator trim handle wound to neutral, I fed in full power to the Continental, which promptly responded with an impressive crescendo of noise and power. With three

Equal-sized wheels are fitted to all three legs of the sturdy Bellanca 260 undercarriage, on which it sits close to the ground.

people on board and about three-quarters fuel, acceleration was quite startling. Some right rudder was needed to keep straight during the very brief ground run, before slight aft wheel pressure sent the Bellanca rocketing skywards from a flaps-up unstick at about 60 m.p.h. Undercarriage retraction takes only 3.9 seconds, and is accompanied by a slight nose-up trim change.

If you do not mind the sensation of lying on your back in what seems an almost vertical climb, you can achieve the optimum angle for obstruction clearance at 101 m.p.h., and even at 120 m.p.h., the best climb-rate speed, the angle is almost uncomfortably steep. The V.S.I. showed just under 2,000 ft./min., and stayed there as I throttled back slightly and dropped the revs. from their take-off maximum of 2,625.

Engine vibration seemed unusually marked in the Bellanca, the flat-six Continental being normally very smooth, and the noise level was also rather above average for an American light aircraft. Improved mounting and soundproofing would be helpful, as would a rudder trimmer to relieve the load on one's right foot during the climb.

Although the rudder is moderately heavy, the Bellanca's climb is sufficient to ensure that it never need be applied for very long. In keeping with the almost fighter-like performance, I found the ailerons of EI-AKR most unusual for an American aeroplane. They were extremely light and sensitive, for very small displacements, in conjunction with barely neutral lateral stability. Harmonization with the elevators was quite good, although the latter were slightly heavier in their accepted place between ailerons and rudder.

Longitudinal trim changes with power were logical and moderate, reduced throttle being accompanied by a gentle nose-down pitch. With an arbitrary cruising power setting of about 23 in.Hg. and 2,300 r.p.m., I noticed that the speed built up very quickly to indicate in the region of 175 m.p.h. at a fairly low altitude. At 20 in.Hg and 2,450 r.p.m. (65% power at 7,500 ft.), the Bellanca trues out at 185 m.p.h. for a consumption of only 10½ Imp. gal./hr. Taking it to 10,000 ft. will return 195 m.p.h. T.A.S. at 63% power, on 10 gal./hr.

The slick-wing Bellanca is certainly a slippery aeroplane, but at 226 m.p.h. I.A.S., it has a reasonable never-exceed speed. I found around Kidlington that it gave a very steady ride, with the positive directional stability one would expect from its three fins, and a general solidity in its flight path. Its handling is such as almost to tempt one into an aerobatic session, except that the Bellanca is built to the normal utility factors of +3.8 and −1.52*g*. (ultimates, +5.7 and −2.28*g*.).

The abbreviated ram's-horn control wheels proved very comfortable in exploiting the 260's manœuvrability, and the controls retained much of their effectiveness down to the stall. Clean, a good strong pull is needed to raise the nose as the throttle is closed, and the undercarriage klaxon is joined by the stall warning horn at about 65 m.p.h. A straight breakaway follows without further warning at 60 m.p.h. or so (70 m.p.h. T.A.S.)

Limit speed for the flaps is 110 m.p.h., and a touch of the selector lever brings them down in a rush. The full 46° is extended in 2½ sec., which is rather precipitate, but the resultant nose-up trim change is small. It is also countered by undercarriage extension, which can be selected below 124 m.p.h., although once down, the gear is cleared for airspeeds up to 180 m.p.h. With a trickle of power in this configuration, the Bellanca sits up and begs at an extraordinary angle, with the stall horn bleeping away, until it pitches down with a port wing drop at about 46 m.p.h. I.A.S. (60 m.p.h. T.A.S.). There is no aerodynamic warning, except possibly for a yaw to port just before the stall.

Although stability remains good in the circuit, for which 100 m.p.h. is a convenient downwind speed, a certain lack of potency is evident in the flaps on the approach. With the full 46° extended, the attitude at 80-85 m.p.h. is rather nose-high, and the forward view therefore suffers. Because of this attitude, I found a tendency to touch down early at an excessive speed, whereas the shortest landing run follows a longish hold off and full-stall arrival.

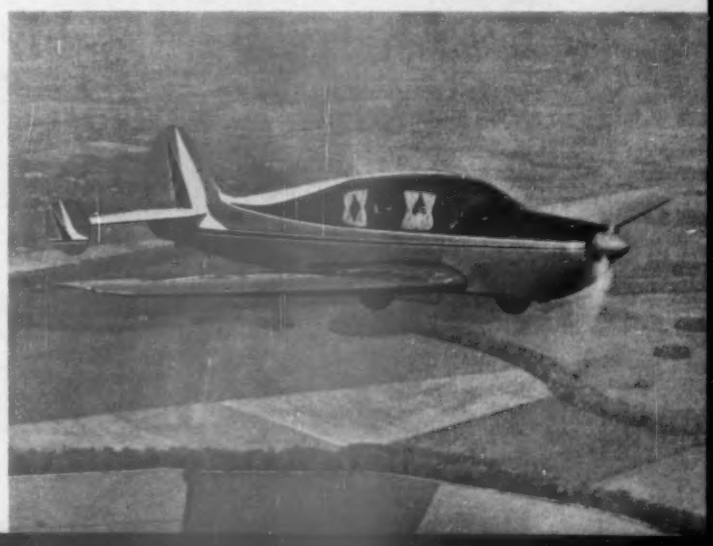
Apart from being slightly underflapped, and for minor details of engine mounting, soundproofing and forward vision, the Bellanca 260 proved most enjoyable to fly. Despite the age of its origin, it contains many desirable design features, and in the world of mass-produced American light-planes, stands out as almost a custom-built model. It is one of the few single-engined light aeroplanes available anywhere in the 200 m.p.h. cruise bracket, which makes its U.K. price, including duty and VMC instruments, but without radio, of £9,105 all the more reasonable.

Technical Data

DIMENSIONS.—Span, 34 ft. 2 in.; length, 22 ft. 11 in.; height, 6 ft. 4 in.; wing area, 161.5 sq. ft.

WEIGHTS.—Empty, 1,690 lb.; fuel (50 gal.), 360 lb.; oil, 13 lb.; four passengers, 680 lb.; max. gross, 2,700 lb.

PERFORMANCE.—Max. speed, 208 m.p.h.; cruise speed, 75% power, at 9,000 ft., 203 m.p.h.; cruise speed, 65% power, at 9,000 ft., 185 m.p.h.; initial climb at gross weight, 1,750 ft./min.; service ceiling, 22,000 ft.; absolute ceiling, 26,500 ft.; take-off distance to 50 ft., 900 ft.; landing distance from 50 ft., 1,050 ft.; range on 33 gal, at 75% power, with 45 min. reserve, 455 miles; range, on 50 gal., 75% power, 45 min. reserve, 752 miles.



Completely sheathed in a glass-fibre skin, the Bellanca 260 airframe is of extremely low-drag design, except for its wire-braced tailplane and semi-stowed undercarriage wheels.

Personal Flying

WHILE there is a profusion of high-wing aeroplanes with fixed nosewheel undercarriages in the lower-price sections of the American market, few designs are available combining a low-wing with a similar landing gear layout. The Americans are traditionally high-wing-minded in the lightplane field, although there is now some evidence that this trend is being reversed.

As one of the leading contenders, Pipers have already turned to the low-wing layout for the fast-selling Comanche, as well as for the Apache and Aztec light-twins. The Cessna twin, the 310, is the only low-wing type in that company's extensive range. Under development as a Tri-Pacer replacement, the Piper Cherokee is a low-wing, all-metal four-seater, presumably with a fixed tricycle gear, and this will remedy the lack of such types previously referred to, if past Piper sales are any indication.

At the moment, however, the only production low-wing touring lightplanes in the United States with non-retractable nosewheel undercarriages are two-seaters, comprising the Fornaire developments of the original Ercoupe (the Executa, Expediter and Explorer), and the Morrisey 2150. Past preference for high-wings is hard to understand, particularly since the crowded air space of the U.S.A. would seem to require the best possible all-round view from lightplane cockpits. In this respect, the American high-wing types are almost universally bad. None has transparent roof panels, and virtually all are completely blind in turns.

• • •

During the first quarter of this year, the seven main light aircraft manufacturers in the United States increased their sales by 20% compared with the corresponding 1959 period. Deliveries totalled some 2,300 aircraft valued at $44.6 million. Breakdown by types was as follows:—

Aero Design: Commander, 24. **Beechcraft:** Bonanza, 110; Debonair, 71; Travel Air, 41; Twin-Bonanza, 31; Queen-Air, 3; Model 18, 28. **Callair:** Callair, 5. **Cessna:** Model 150, 80; Model 172, 214; Model 175, 163; Model 180, 85; Model 182, 221; Model 210, 234; Model 310, 90. **Champion:** All types, 64. **Mooney:** Mk. 20, 50. **Piper:** Pawnee, 99; Super Cub, 103; Tri-Pacer, 192; Comanche 180, 135; Comanche 250, 167; Apache, 18; Aztec, 91.

Of this total, 324 aircraft were exported, with a value of $5.6 million. This was an increase of 67% in numbers, compared with the first quarter of 1959, and of 118% in financial return.

RUSSIAN AKROBAT.—DOSAAF, the Soviet sporting flying organization, has taken delivery of a number of Zlin Z.226 trainers, including the single-seat Akrobat version, from Czechoslovakia.

In addition to the little P.Z.L. Kos, which has received some prominence in our pages in connection with its recent visit to this country, the Polish aircraft industry is concerned with several other lightweight designs. Developed from the Russian Yak-12, the P.Z.L. 101 Gawron is being produced for agricultural operations (101G-1), or as the 101G-2 for conversion as a general cargo transport, after removal of the container and spraying equipment.

The SM-1 helicopter, which was also developed from a Russian design (the Mi-1), has been exported in considerable numbers, and is being used extensively in Poland. In its basic form it is intended for liaison, light cargo transport and parachute training, but it is also being produced in several specialized variants. These include the SM-1S, for air ambulance duties, accommodating two stretcher cases and attendant in addition to the crew; the SM-1Z agricultural modification; the SM-S2 executive five-seater and the SM-1SZ trainer.

Poland has now become a leading exporter of sailplanes throughout the World and has produced large numbers of Jaskolkas, Salamandras, Czaplas, Bocians and Muchas. In the recent World Gliding Championships, two new types of high-performance sailplanes were introduced, the SZD-19 Zefir 2 and the SZD-24 Foka.

Gliding Championship Results

RUDOLFO HOSSINGER, from the Argentine, won the World Gliding Championship with a score of 5,102.9 points for the six days of the contest. His sailplane was a Slingsby Skylark III. Hossinger, aged 31, was the first pilot from Argentina to win the championships. This year his performance was very much better than during the previous championships two years ago, when he came 33rd out of 37.

Second and third places in the Open Class were taken by two Polish pilots, E. Makula with 5,079.1 points and J. Popiel with 5,020.7 points. Fourth came Cdr. Nicholas Goodhart, who flew an Olympia 419 produced by Elliotts of Newbury. Hossinger took the leading position from Goodhart, whose final score was 4,856.5 points, on Jne. 16. During the last championships Goodhart came second to Ernst-Gunther Haase, of Germany, who finished ninth this time.

Fifth place went to Sven Jonsson, of Sweden, who had 4,443.6 points and sixth was J. Ortner, of the Argentine, who also flew a Skylark III.

The second British pilot who flew a Skylark III in the Open Class was Col. A. J. Deane-Drummond, who came 12th with 3,184.7 points. The total field in this event was 20. Mr. Tony Gaze, of Australia, came 14th.

In the Standard Class for sailplanes of 15 m. span, Heinz Huth, of Germany, flying a Ka-6, won with a score of 5,619.1 points. Second was G. Munch, of Brazil, with 5,237.8 points and third A. Witek, of Poland, who was the previous champion; he had 5,201.9 points.

E. J. Harrold, of Southern Rhodesia, who was flying in his first championship, came 10th and Robert Rowe, of Australia, was 20th. Cdr. Antony Goodhart came 24th. There were 35 competitors in this class.

Experience at the championships showed that the highly efficient sailplanes are difficult to beat in the best weather for soaring, but that in poor weather they are often at a disadvantage compared with less specialized types.

Following his second report on the championships, our gliding correspondent sent further news of the contestant who landed in East Germany, and of some of the other difficulties that had arisen. A.E.S. wrote:—

The problem of getting Dick Schreder out of East Germany proved rather easier than that of finding whether he had got there, instead of the other way round, as was feared. He was back at Butzweiler with his machine 40 hr. after take-off.

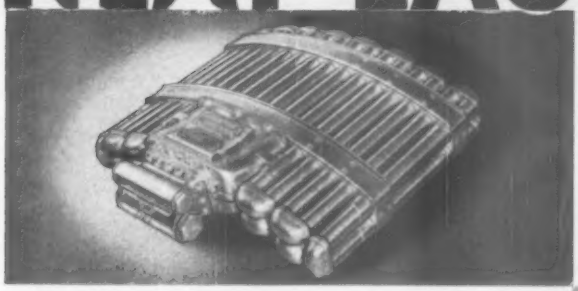
Shortly after this another problem was settled—that of finding out whether Tony Goodhart's 20,000-ft. climb on Jne. 6 was made in cloud. Tony settled it for them by admitting he had gone into cloud, and offered to withdraw his marks for that day. This offer was accepted by the organizers, with the result that he was then placed 28th, not 11th, in the Standard Class.

Yet another problem came before the organizers as a result of interference, by a depression from England, with the task set on Saturday, Jne. 11. To make it a "contest day" in either Class, at least two pilots must, according to the rules, have each covered 50 km. But the task was distance along a set line to the S.S.E., with penalties for landing off course.

As it happened, in the Open Class Nick Goodhart made a very difficult 86 km. (53 miles), starting with sparse, weak thermals and finishing with slope-soaring along the hills bordering the Rhine as far as Boppard. Harald Jensen, of Denmark, flew slightly farther to Limburg, but was so much off course that the distance for which he earned marks was less than 50 km. No one else in the Class got anything like as far.

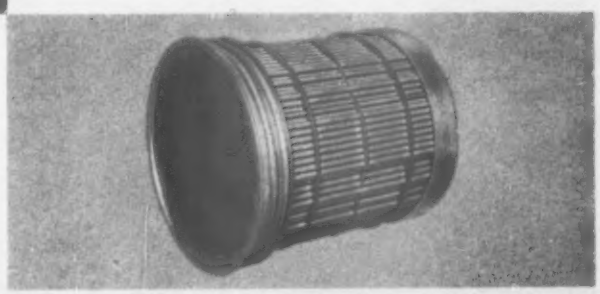
So, did the rules apply to Jensen's whole distance or only that for which he was marked? The organizers decided on the former, so it *was* a contest day, and Nicholas Goodhart jumped ahead of the two Poles into the lead. They had been the only two competitors in front of him, but as Edward Makula went a short distance and Jerzy Popiel went nowhere, Nick at that stage was hundreds of points ahead of his nearest rivals.

HEAT EXCHANGERS



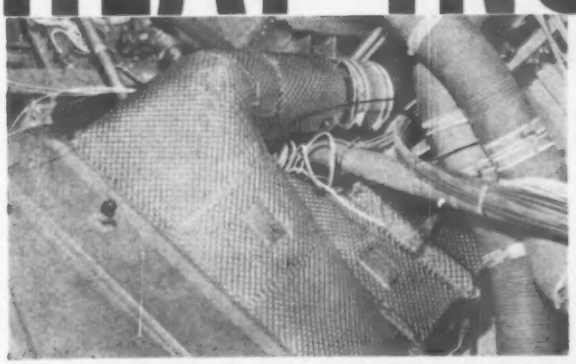
For any purpose. In any metal—especially very thin gauge aluminium and stainless steel. We design and manufacture. We service all makes, English and American.

Light alloy oil cooler/fuel heater fitted to the Bristol Siddeley "Sapphire" S.A.7 engine.



Replacement unit for light alloy oil cooler for the Rolls-Royce "Dart" engine.

HEAT INSULATION



We were pioneers in this field and to-day are leaders. Our hermetically sealed blankets and ducting provide high insulation, low weight, easy access. Awkward shapes present no problems.

Insulated ducting fitted to the heat exchanger of the Handley Page "Herald".

Thermal insulation blanket for the Vickers "Vanguard". Its job is to protect the fuel tanks from the heat of the jet pipe.

We shall be glad to discuss your problems in both these fields.

Delaney Gallay LTD

Vulcan Works, Edgware Road, London, N.W.2.

Telephone: **GLAdstone 2201**

Personal Flying

WHILE there is a profusion of high-wing aeroplanes with fixed nosewheel undercarriages in the lower-price sections of the American market, few designs are available combining a low-wing with a similar landing gear layout. The Americans are traditionally high-wing-minded in the lightplane field, although there is now some evidence that this trend is being reversed.

As one of the leading contenders, Pipers have already turned to the low-wing layout for the fast-selling Comanche, as well as for the Apache and Aztec light-twins. The Cessna twin, the 310, is the only low-wing type in that company's extensive range. Under development as a Tri-Pacer replacement, the Piper Cherokee is a low-wing, all-metal four-seater, presumably with a fixed tricycle gear, and this will remedy the lack of such types previously referred to, if past Piper sales are any indication.

At the moment, however, the only production low-wing touring lightplanes in the United States with non-retractable nosewheel undercarriages are two-seaters, comprising the Fornaire developments of the original Ercoupe (the Executa, Expediter and Explorer), and the Morrisey 2150. Past preference for high-wings is hard to understand, particularly since the crowded air space of the U.S.A. would seem to require the best possible all-round view from lightplane cockpits. In this respect, the American high-wing types are almost universally bad. None has transparent roof panels, and virtually all are completely blind in turns.

• • •

During the first quarter of this year, the seven main light aircraft manufacturers in the United States increased their sales by 20% compared with the corresponding 1959 period. Deliveries totalled some 2,300 aircraft valued at $44.6 million. Breakdown by types was as follows:—

Aero Design: Commander, 24. **Beechcraft:** Bonanza, 110; Debonair, 71; Travel Air, 41; Twin-Bonanza, 31; Queen-Air, 3; Model 18, 28. **Callair:** Callair, 5. **Cessna:** Model 150, 80; Model 172, 214; Model 175, 163; Model 180, 85; Model 182, 221; Model 210, 234; Model 310, 90. **Champion:** All types, 64. **Mooney:** Mk. 20, 50. **Piper:** Pawnee, 99; Super Cub, 103; Tri-Pacer, 192; Comanche 180, 135; Comanche 250, 167; Apache, 18; Aztec, 91.

Of this total, 324 aircraft were exported, with a value of $5.6 million. This was an increase of 67% in numbers, compared with the first quarter of 1959, and of 118% in financial return.

RUSSIAN AKROBAT.—DOSAAF, the Soviet sporting flying organization, has taken delivery of a number of Zlin Z.226 trainers, including the single-seat Akrobat version, from Czechoslovakia.

In addition to the little P.Z.L. Kos, which has received some prominence in our pages in connection with its recent visit to this country, the Polish aircraft industry is concerned with several other lightweight designs. Developed from the Russian Yak-12, the P.Z.L. 101 Gawron is being produced for agricultural operations (101G-1), or as the 101G-2 for conversion as a general cargo transport, after removal of the container and spraying equipment.

The SM-1 helicopter, which was also developed from a Russian design (the Mi-1), has been exported in considerable numbers, and is being used extensively in Poland. In its basic form it is intended for liaison, light cargo transport and parachute training, but it is also being produced in several specialized variants. These include the SM-1S, for air ambulance duties, accommodating two stretcher cases and attendant in addition to the crew; the SM-1Z agricultural modification; the SM-S2 executive five-seater and the SM-1SZ trainer.

Poland has now become a leading exporter of sailplanes throughout the World and has produced large numbers of Jaskolkas, Salamandras, Czaplas, Bocians and Muchas. In the recent World Gliding Championships, two new types of high-performance sailplanes were introduced, the SZD-19 Zefir 2 and the SZD-24 Foka.

Gliding Championship Results

RUDOLFO HOSSINGER, from the Argentine, won the World Gliding Championship with a score of 5,102.9 points for the six days of the contest. His sailplane was a Slingsby Skylark III. Hossinger, aged 31, was the first pilot from Argentina to win the championships. This year his performance was very much better than during the previous championships two years ago, when he came 33rd out of 37.

Second and third places in the Open Class were taken by two Polish pilots, E. Makula with 5,079.1 points and J. Popiel with 5,020.7 points. Fourth came Cdr. Nicholas Goodhart, who flew an Olympia 419 produced by Elliotts of Newbury. Hossinger took the leading position from Goodhart, whose final score was 4,856.5 points, on Jne. 16. During the last championships Goodhart came second to Ernst-Gunther Haase, of Germany, who finished ninth this time.

Fifth place went to Sven Jonsson, of Sweden, who had 4,443.6 points and sixth was J. Ortner, of the Argentine, who also flew a Skylark III.

The second British pilot who flew a Skylark III in the Open Class was Col. A. J. Deane-Drummond, who came 12th with 3,184.7 points. The total field in this event was 20. Mr. Tony Gaze, of Australia, came 14th.

In the Standard Class for sailplanes of 15 m. span, Heinz Huth, of Germany, flying a Ka-6, won with a score of 5,619.1 points. Second was G. Munch, of Brazil, with 5,237.8 points and third A. Witek, of Poland, who was the previous champion; he had 5,201.9 points.

E. J. Harrold, of Southern Rhodesia, who was flying in his first championship, came 10th and Robert Rowe, of Australia, was 20th. Cdr. Antony Goodhart came 24th. There were 35 competitors in this class.

Experience at the championships showed that the highly efficient sailplanes are difficult to beat in the best weather for soaring, but that in poor weather they are often at a disadvantage compared with less specialized types.

Following his second report on the championships, our gliding correspondent sent further news of the contestant who landed in East Germany, and of some of the other difficulties that had arisen. A.E.S. wrote:—

The problem of getting Dick Schreder out of East Germany proved rather easier than that of finding whether he had got there, instead of the other way round, as was feared. He was back at Butzweiler with his machine 40 hr. after take-off.

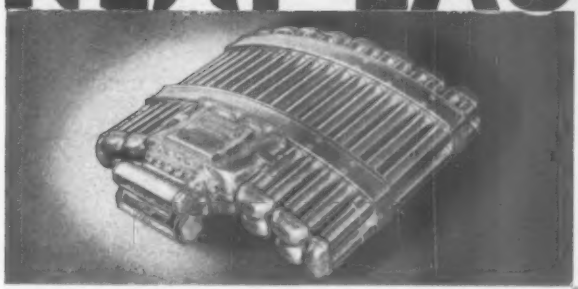
Shortly after this another problem was settled—that of finding out whether Tony Goodhart's 20,000-ft. climb on Jne. 6 was made in cloud. Tony settled it for them by admitting he had gone into cloud, and offered to withdraw his marks for that day. This offer was accepted by the organizers, with the result that he was then placed 28th, not 11th, in the Standard Class.

Yet another problem came before the organizers as a result of interference, by a depression from England, with the task set on Saturday, Jne. 11. To make it a "contest day" in either Class, at least two pilots must, according to the rules, have each covered 50 km. But the task was distance along a set line to the S.S.E., with penalties for landing off course.

As it happened, in the Open Class Nick Goodhart made a very difficult 86 km. (53 miles), starting with sparse, weak thermals and finishing with slope-soaring along the hills bordering the Rhine as far as Boppard. Harald Jensen, of Denmark, flew slightly farther to Limburg, but was so much off course that the distance for which he earned marks was less than 50 km. No one else in the Class got anything like as far.

So, did the rules apply to Jensen's whole distance or only that for which he was marked? The organizers decided on the former, so it *was* a contest day, and Nicholas Goodhart jumped ahead of the two Poles into the lead. They had been the only two competitors in front of him, but as Edward Makula went a short distance and Jerzy Popiel went nowhere, Nick at that stage was hundreds of points ahead of his nearest rivals.

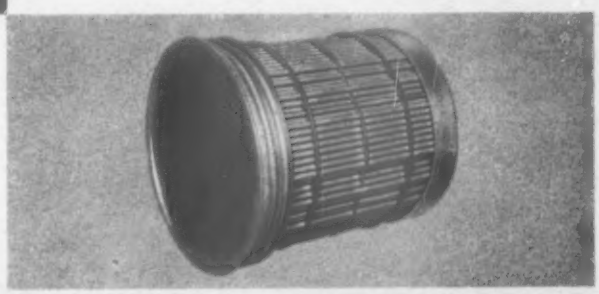
HEAT EXCHANGERS



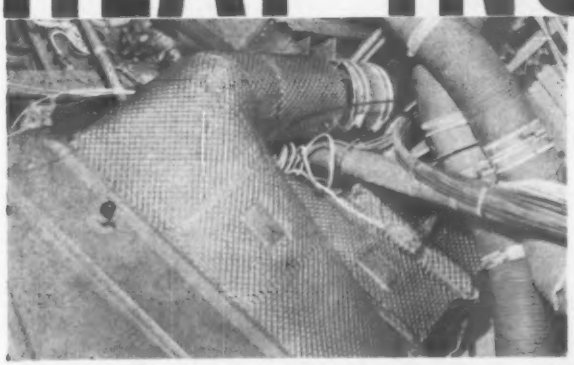
For any purpose. In any metal—especially very thin gauge aluminium and stainless steel. We design and manufacture. We service all makes, English and American.

Light alloy oil cooler/fuel heater fitted to the Bristol Siddeley "Sapphire" S.A.7 engine.

Replacement unit for light alloy oil cooler for the Rolls-Royce "Dart" engine.



HEAT INSULATION



We were pioneers in this field and to-day are leaders. Our hermetically sealed blankets and ducting provide high insulation, low weight, easy access. Awkward shapes present no problems.

Insulated ducting fitted to the heat exchanger of the Handley Page "Herald".

Thermal insulation blanket for the Vickers "Vanguard". Its job is to protect the fuel tanks from the heat of the jet pipe.

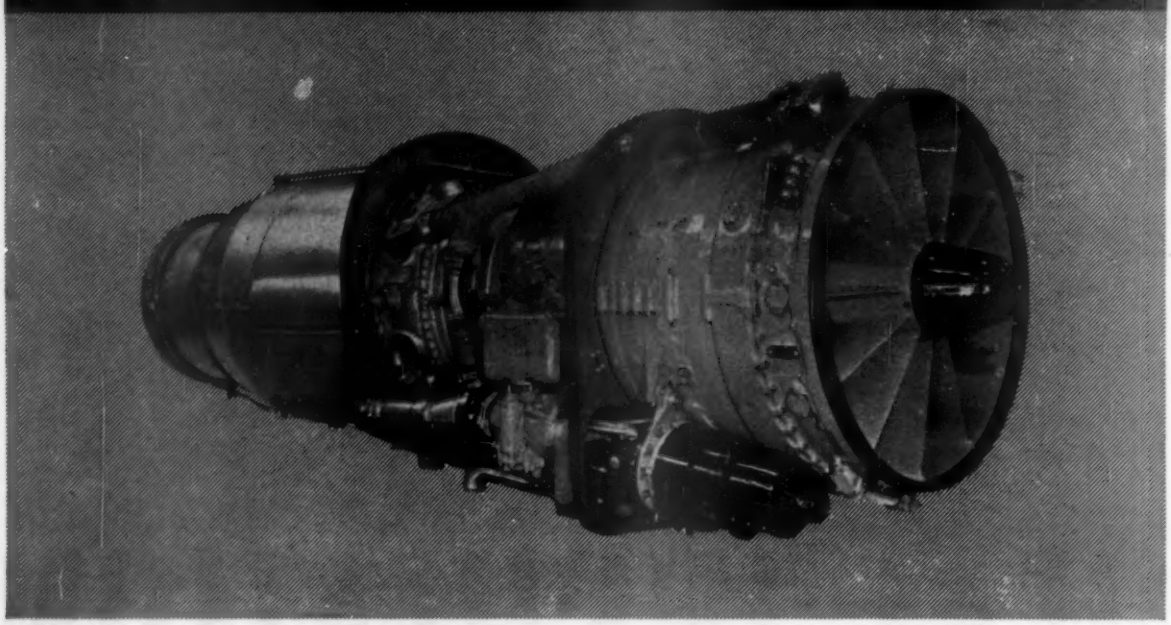
We shall be glad to discuss your problems in both these fields.

Delaney Gallay LTD

Vulcan Works, Edgware Road, London, N.W.2.

Telephone: **GLAdstone 2201**

Latest Olympus version—ready for production—produces 20,000-lb thrust dry...



...ANOTHER ENGINEERING ADVANCE BY BRISTOL SIDDELEY

Security restrictions have just been lifted to permit the release of some details of the current Olympus version, the 21, which is now ready for production.

157-in long and with a 42-in intake diameter, the Bristol Siddeley Olympus 21 is Britain's most powerful military aero-engine. It inherits all the outstanding qualities of its forebears—high power at high altitude, unequalled handling characteristics, low fuel consumption and great operational flexibility. It also possesses the highest thrust/weight ratio of any high-thrust turbojet in the world.

The Olympus series of engines owes its excellent all-round performance to the two-spool compressor system, pioneered by Bristol Siddeley and since adopted by the leading aero-engine producers in Britain and the USA. Proof of Olympus reliability is given by the fact that it has the *longest achieved overhaul life*, the *lowest specific fuel consumption* and the *highest thrust* of any bomber or fighter engine in squadron service with the RAF.

The enormous development potential of the Olympus has repeatedly been proved. The first production version delivered 11,000-lb thrust dry, the current Olympus 21 has reached 20,000 lb, and an even later version is rated at no less than 33,000 lb with reheat.

Olympus applications

The Olympus 201 already gives the Avro Vulcan B 2, spearhead of the RAF's V-bomber force, an all-round performance unsurpassed by any other aircraft of its type. The Olympus 21 has been designed to allow the Vulcan to reach its ultimate design potentialities.

The Bristol Siddeley Olympus is ideally suited to operation at transonic speeds and an advanced version has been selected to power the British Aircraft Corporation's TSR 2, a new tactical support/reconnaissance aircraft chosen for the RAF. Other Olympus versions are under active consideration for the next generation of civil airliners—the supersonic transports.

BRISTOL SIDDELEY ENGINES LIMITED

Correspondence

Cost of Caribbean Flying

MAY we be permitted space to add to your editorial comment to Mr. R. A. Smith's letter in your Jne. 10 issue regarding the cost of Caribbean flying.

Experience is indicating that the petrol consumption of the Caribbean is, in practice, nearer 5 than 7½ gallons per hour. Thus the operating cost to a private owner under our Rent-a-Plane scheme, assuming an annual utilization of 200 hours, is little over £6 per hour.

Group operation qualifying for petrol tax rebate would reduce this figure to approximately £5 10s. per hour.

Mr. Smith's comment is valid except, surely, clubs should expect to achieve an annual utilization in excess of 200 hours? We are surprised to learn that Mr. Smith finds it necessary to pay his excellent staff, but we agree that, taking this into consideration and basing costs on an annual utilization of nearer 400 hours, a figure of £7 per hour is the lowest economic price to charge for club operation of this aircraft.

London, W.11. J. RISELEY-PRICHARD, Rent-a-Plane, Ltd.

Spotlight on B.E.A.'s Fleets

HAVING much enjoyed reading "From Viking to Comet 4B" by your worthy contributor, H.A.T. (Apr. 1 issue, pages 405-407), may I, as a longstanding admirer of B.E.A.'s way of doing things, and its outstanding achievements in almost all aspects of running a really successful domestic/international airline, add a few friendly and, I hope, interesting comments hereunder.

First, I trust H.A.T. will forgive me if, merely for the sake of historical interest, I briefly list those British-built aeroplanes operated by B.E.A. in its earlier years and which the author has, no doubt purposely, had to omit in his report. Back in 1947-48, there were two Avro Lancastrians, G-AHBX and G-AHBY, which, I believe, were used by B.E.A.'s Experimental Unit: also one or two D.H. Mosquitos were flown by the same Unit and in these aeroplanes Capt. Derek Mason and the late Capt. Karel Kuttelwascher performed much vital research into dangerous icing conditions, etc. An Auster Autocrat, G-AGVM, was owned in those years, but far more noteworthy was the grand old D.H. 84 Dragon, G-ACIT (circa 1933, originally Scottish Airways). This remarkable veteran biplane, after serving B.E.A. and then the Airways Aero Club is still going strong in 1960, its owners being the Air Navigation & Trading Co., Ltd. What an aircraft!

Apart from the nine reconditioned Junkers Ju52/3ms operated in 1946-47, probably the oldest non-British aeroplane used by B.E.A. for at least one summer season in 1946-48 was the chartered Scottish Airlines' Fokker F-22, G-AFZP which I well remember seeing in S.A.L.'s main hangar at Prestwick when I first arrived there in October, 1948. By then, she must have been permanently "grounded" because I never saw her fly during my four odd years of working at Prestwick Airport. But I do seem to recall that she operated the Glasgow/Belfast holiday season "peaks" in 1947(?). Pre-1939 Croydon Airport staff will remember her when she was K.L.M.'s PH-AJP "Roerdomp."

Another not-so-well-known former member of B.E.A.'s fleet is a sole Bristol 170 Freighter, G-AICS, bearing the unique name R.M.A. "Yeoman." Acquired by B.E.A. on Aug. 16, 1950, she was eventually leased to Silver City Airways on Jne. 10, 1952, by which time 2,720 hr. had been logged by her since she left her Filton birthplace. On May 1, 1957, the B.170 was sold to Silver City, but her hard-working career came to a most tragic end less than a year later when, on charter, she crashed on Winter Hill.

In contrast to the last-named ex-B.E.A. aeroplane, the veteran Vickers Viking G-AHOP, R.M.A. "Valerie" (shown in your photograph on page 405), after being sold by B.E.A. in 1947 and afterwards leased by the M.C.A. to a couple of long-since defunct charter operators, eventually was sold to Airwork in 1952. For about four years she carried thousands (her share of) contented and satisfied passengers on the much-loved Safari Flights between the U.K. and Nairobi. H.A.T.'s own report, "The New Deal in Practice," in your Jly. 4, 1952, issue, faithfully records his own impressions of these earliest Viking Series. This particular Viking later became the personal V.I.P. transport of the Hon. T. L. E. B. Guinness, Airwork's President up to the time of the amalgamation of this independent with Hunting-Clan. Early in 1959, stripped of her luxury V.I.P.-type furnishing, she once again resumed her career in Airwork's Viking fleet and is still shown on the current U.K. Register under the ownership of United Airways, Ltd.

In conclusion, B.E.A.'s grand "old" DC-3, R.M.A. "Albert Ball," G-AGHJ (I flew in her, Gatwick-Guernsey, in Jne., 1958, and I enjoyed one of my smoothest-ever rides in 20 years as an airline passenger) still has the "honour" of being the first DC-3 listed on the U.K. Register. Bearing Douglas' C.N. 9413 and originally delivered to the R.A.F. in 1943, she's rather a youngster compared to vast numbers of her sister-veterans! Just the same, with 22,000-plus airframe hours to her credit, I've little doubt she'll still be with us for many years ahead; B.E.A. will have plenty of eager buyers for the remainder of their Pionairs when these truly great aeroplanes are freed to go to new owners.

Nairobi, Kenya. DENNIS M. POWELL.

Groundabout

Compass Point of No Return. The "360° reciprocal" business referred to here recently, will always, it seems, be with us. I'm told that after an American pilot had landed at Prestwick one day last year, he asked if he could do a 360 and back track. The controller was both friendly and helpful: "You can if you like but a 180 would be better."

*

In the Mess bar: "Oh, yes, I enjoyed the course—the flying was easy—it was getting up in the morning that was terrible."

*

A member of the Indian branch of the Friends of Wren sends a cutting from the *Deccan Herald* which reveals the lengths that airlines must go to, even on an inaugural flight, to fill their aircraft. Speaking of Air India's inaugural 707 flight from Bombay to New York, the paper reports: "Besides Minister of State Rajbahadur and some travel agents, the rest were paid passengers." They also say that Mr. J. R. D. Tata, Air India chairman, was, for economic reasons, opposed to having an inaugural flight. He wanted to inaugurate the service with the *second* flight, I suppose.

*

Avro Egg-whisk. The recent amusing and harmless accident, when an R.A.F. Anson crashed on an egg factory near Northolt, prompts reader J. H. Grant to suggest that one of the best ways of making scrambled eggs is just that—fly a twin-prop aircraft into a million eggs.

*

Dobbie Again. When Sir Roy Dobson visited one of the companies taken over by the Hawker Siddeley Group, he saw on a gate the notice "No Hawkers." For the purposes of this story he is alleged to have said, "That must come down for a start."

*

One for the Line Book. "A Vickers Valiant jet bomber flew from the Butterworth Airfield, Malaya, to Markham [meaning Marham], Norfolk, in 6 hours 16¼ minutes . . . This was the same plane which flew from Britain to Singapore in 15 hours 35 minutes last week."—*Daily Telegraph*, 2.6.60. Obviously, they picked up a Vickers P.R.O. for the return flight.

by Wren

Industry Record

Titanium Symposium

Last month the Metals Division of Imperial Chemical Industries, Ltd., held a two-day symposium on "Titanium Production Methods in the Aircraft Industry." Some 80 senior technicians, representing all the major aircraft engineering concerns, heard and discussed papers on various aspects of fabricating titanium, including drop forging, machining, sheet metal work and welding.

Of the 14 speakers, 12 came from aircraft manufacturing companies or aircraft component suppliers; the remaining two represented the Production Engineering Research Association. The scope of the symposium emphasized the present status of titanium as a structural material in the aircraft industry, and its rapid development over the five years since I.C.I. commissioned Britain's first titanium plants.

Engineering at Gatwick

The first of three timber hangars to be built at the engineering base of Overseas Aviation (C.I.), Ltd., at Gatwick was officially opened last week by Mr. Geoffrey Rippon, Parliamentary Secretary, Ministry of Aviation. Stated to be the largest industrial timber structure in this country, the hangar has a clear span of 150 ft. with clear headroom of 33 ft., the entire roof and side cladding being supported on six frames spaced at 30-ft. centres, giving a 150-ft. depth from front to rear.

Designed by P. and D. T. Myers of London in collaboration with Beves and Co. (Structures), Ltd., the structural framework of the hangar was built in 16 weeks and erected in four weeks. The roof has a 2-in. Stramit decking lined with asbestos paper and a felt covering externally. The side cladding consists of an outer sheet of a sandwich wall, Rocksil insulation and an inner lining of Asbestolux. It has top hung folding-sliding doors.

The new Overseas Aviation timber hangar at Gatwick Airport.

The choice of this form of construction was based on economy in cost, fire endurance and negligible maintenance costs. In addition, there were other advantages in lighter foundations, speedy erection and simplicity of fixings for roof and side cladding and internal fittings. The fire endurance of the structure has been achieved in conjunction with the Fire Offices Committee, the Fire Research Organization at Boreham Wood and the Ministry of Aviation by increasing the bulk of the timber used and stipulating minimum thicknesses of individual members. The building framework has a fire rating of one hour before collapse.

Airfield Radar Order

Decca Radar have been awarded a contract to supply the Royal Ceylon Air Force with a Decca 424 Mk.2 airfield control radar. It will be installed at Katunayake, a military airfield which is also used by civil airlines operating scheduled flights.

Until recently, radar control was provided at Katunayake by the R.A.F. using an ACR 7D—the Service version of the 424—but this equipment has now been transferred to another base. The 424 is a fully duplicated high-definition radar landing aid operating in the X-band (3 cm.) and incorporates variable polarization for the suppression of rain echoes. The operator is able to "tune out" rain by varying the polarization of the radar transmissions by a single control at the display position.

In addition to the R.A.F. and R. Ceylon A.F. there are many overseas air forces who already use the Decca 424 airfield control radar. Over 100 units have been installed in all parts of the World for Service and civil operation.

Publications Received

British Civil Aircraft, 1919-59, Vol. 2.—The second half of a work already established as the standard authority on British civil registered aircraft, containing details of all aeroplanes registered in Britain with manufacturers' names, from Edgar Percival to Zlin. By A. J. Jackson. 600 pp.; 5¼ in. by 8¼ in. Illustrated. Putnam and Co., Ltd. Price £3 3s.

Final Approach.—Readable novel with air safety as its theme and airline operations as its setting. By Christopher Hodder-Williams. 256 pp.; 5¼ in. by 7¼ in. Hodder and Stoughton, Ltd. Price 15s.

Space Travel. Latest title in the series of Muller True Books, particularly for young people. By Kenneth Johns. 144 pp.: 5 in. by 7¼ in. Illustrated. Frederick Muller, Ltd. Price 8s. 6d.

Aviation Calendar

Jne. 25

Staverton Aerodrome.—Air Show, organized by Cheltenham and Gloucester R.A.F. Association, at 15.00 hrs.

Escoubiac, la Baule.—Invitation Air Rally for Members and Associate Members of the Royal Aero Club; until Jne. 27.

Jne. 28

London.—Guild of Air Pilots and Air Navigators presentation of Meteorological Office Awards, at 14 South Street, Park Lane, W.1, at 16.00 hrs.

Jly. 2

St. Gatien, Deauville.—Invitation Air Rally for Members and Associate Members of the Royal Aero Club; until Jly. 4.

Jly. 4

Harrogate.—British Computer Society Conference. In the Sun Pavilion.

Jly. 8

Baginton, Coventry.—Lockheed International Aerobatic Competition and King's Cup Air Race, organized by the Royal Aero Club; and Jly. 9.

Jly. 10

Elstree.—Pilots' Rally, organized by the Elstree Flying Club, at Elstree Aerodrome.

Jly. 16

Odiham.—Inter Command R.A.F. Gliding and Soaring Association Gliding Week; until Jly. 23.

Jly. 17

Woburn Abbey.—Rally organized by the Royal Aero Club.

Jly. 21

London.—Third International Conference on Medical Electronics and Associated Scientific Exhibition, organized by the Electronics and Communication Section of the Institution of Electrical Engineers, at Olympia; until Jly. 27.

Jly. 23

Odiham.—Inter-Service Gliding week; until Aug. 1.

Company Notices

NEW COMPANIES

Edghill Equipment, Ltd. (660,759).—Private co. Reg. May 27. Cap. £1,000 in £1 shs. Manufacturers and dealers in equipment for the aircraft industry. Directors: Richard T. Hurst, Friars Croft, Markland Hill Lane, Bolton; Hamo Percival; Andrew D. Mills; Howard W. Edghill, Oak Trees, Nately Scures, Hook, Hants; Anthony C. Brooking; Gordon K. Herzog. Sec.: Joan K. Wheeler. Reg. off.: Station Road, Hook, Nr. Basingstoke, Hants.

BP (Far East), Ltd. (660,875).—Private co. Reg. May 30. Cap. £1,000 in £1 shs. Dealers in and refiners of petroleum and other mineral oils. Subscribers: British Petroleum Co., Ltd., Kenilworth Oil Co., Ltd., and Melrose Oil Trading Co., Ltd. Sec.: T. MacDonald. Sols.: Linklaters and Paines, E.C.2. Reg. off.: Britannic House, Finsbury Circus, London, E.C.2.

New Patents

APPLICATIONS ACCEPTED

842,363.—**Vickers-Armstrongs (Aircraft), Ltd.,** and **Wallis, B. N.**—"Aeroplanes."—Sept. 9, 1957. (Sept. 17, 1956.)

842,370.—**Fairey Co., Ltd.,** formerly **Fairey Aviation Co., Ltd.**—"Combination of a body with salvage gear."—Oct. 17, 1957. (Oct. 17, 1956.)

842,354.—**Dowty Fuel Systems, Ltd.**—"Variable liquid supply systems."—Aug. 2, 1957. (Aug. 7, 1956.)

Printed specifications of the above will be available on Jly. 27, 1960, and the opposition period will expire on Oct. 27, 1960.

843,389.—**Blackburn Group, Ltd.,** formerly **Blackburn and General Aircraft, Ltd.,** and **Clark, F. M.**—"Emergency release device for extractor parachutes."—Jan. 9, 1959.

843,512.—**Soc. d'Etudes et de Constructions Aéro-Navales.**—"Detachable tank for aircraft and similar purposes."—Oct. 14, 1957. (Nov. 16, 1956.)

843,269.—**Martin-Baker Aircraft Co., Ltd.,** and **Martin, J.**—"Aircraft ejection seats."—Nov. 12, 1957. (Dec. 28, 1956.)

842,971.—**United Aircraft Corporation**—"Directional control means for supersonic vehicles."—Aug. 12, 1955.

843,359.—**Rolls-Royce, Ltd.**—"Power plant installation for aircraft."—Aug. 15, 1958. (Sept. 2, 1957.)

Printed specifications of the above will be available on Aug. 4, 1960, and the opposition period will expire on Nov. 4, 1960.

Personal Notices

BIRTHS

Bennett.—On Jne. 8, at the R.A.F. Hospital, Ely, to Ann (*née* Patteson), wife of Wg. Cdr. Bennett—a daughter.

Christey.—On Jne. 12, at Brentwood Maternity Home, to Gillian (*née* Isaard Brown), wife of Flt. Lt. J. D. Christey—a daughter.

Harris.—On Jne. 12, at King's Lynn Hospital, to Fay (*née* Woodfine), wife of Flt. Lt. A. C. Harris—a son.

Lowe.—On Jne. 6, in South Australia, to Dorothy, wife of Flt. Lt. Donald W. Lowe—a son.

McNair.—On Jne. 11 at Nairn, to Honor (*née* Greville-Giddings), wife of Flg. Off. I. S. McNair—a daughter.

Offord.—On Jne. 10, to Vivien, wife of Flt. Lt. Ray Offord—a son.

Pond.—On May 30, at R.A.F. Hospital, Wegberg, B.F.P.O. 40, to Joy, wife of Flt. Lt. Gerald Pond—a son.

Robinson.—On Jne. 7, at R.A.F. Hospital, Nocton Hall, Lincoln, to Drusilla (*née* Bush) wife of Sqn. Ldr. M. M. J. Robinson—a daughter.

DEATHS

Devine.—On Jne. 1, Flt. Lt. Colin David Devine.

Parsons.—On Jne. 8, at the R.A.F. Hospital, Wroughton, Sqn. Ldr. C. F. G. Parsons.

Pearce.—On Jne. 10, Plt. Off. David Edward Pearce.

Wood.—On Jne. 10, Flt. Lt. Stanley Wood.

Jet Provost

Powered by the Bristol Siddeley Viper

in service with the Royal Air Force

With pride we announce the continuing exclusive use of HUNTING designed and manufactured primary/basic trainers in the Royal Air Force.

After the most thorough evaluation ever given to any training aircraft, the Jet Provost T.Mk.3. is now in operation at Royal Air Force Basic Flying Training Schools.

Similar to the T.Mk.3. but fitted with armament in addition, the Jet Provost T.Mk.51. is in service with the Royal Ceylon Air Force.

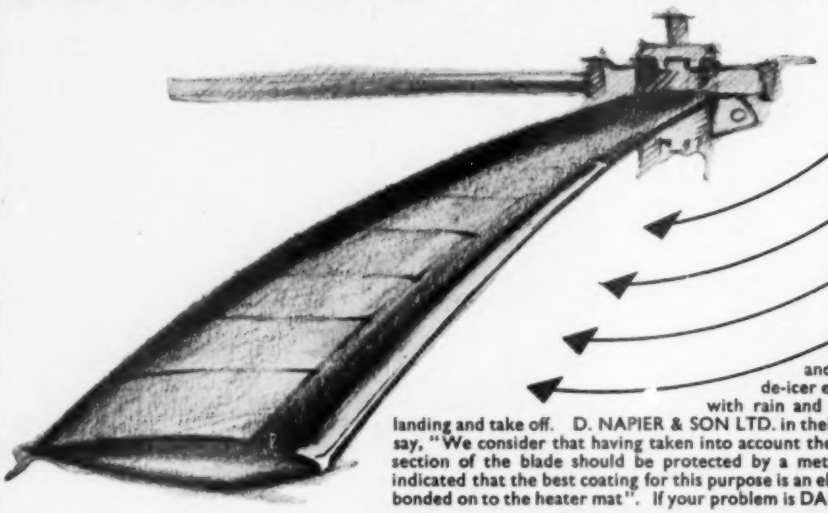
HUNTING AIRCRAFT LIMITED

Member Company of British Aircraft Corporation

LUTON AIRPORT, BEDFORDSHIRE, ENGLAND

AP390

MICROGRAIN NICKEL PROTECTION AGAINST **DAMAGE**



Electroforms of Micrograin nickel on the leading edges of aircraft propellers and helicopter rotors protect the delicate de-icer elements against rupture due to impact with rain and hail in flight or with stones during landing and take off. D. NAPIER & SON LTD. in their Spraymat information bulletin IB/SII say, "We consider that having taken into account the aircraft forward speed the outboard section of the blade should be protected by a metallic coating. Extensive testing has indicated that the best coating for this purpose is an electroformed Micrograin nickel sheath bonded on to the heater mat". If your problem is DAMAGE, the solution is MICROGRAIN.

METACHEMICAL PROCESSES LIMITED
41/43, Gatwick Road · Crawley · Sussex Telephone: CRAWLEY 25241/3
Associated Company, SIFCO METACHEMICAL INC.
935 EAST 63rd STREET · CLEVELAND 3 · OHIO · U.S.A.

Commission paid to any brokers introducing clients

for

VISCOUNTS

and

VIKINGS

BARE HULL CHARTER

from

MAITLAND DREWERY

128 STATION ROAD
SIDCUP · KENT
Telephone: FOOtscray 6761

EXECUTIVE DOVE

★ Just completing overhaul.
★ Under 2,000 hours since new.
★ Completely refurnished.
★ Low engine hours, new propellers.
★ Twin V.H.F. and A.D.F.
★ Fitted Bar (stocked).
★ Full de-icing.

This almost new aircraft can be either purchased or rented for short periods, or by the year.

Full details on request to:

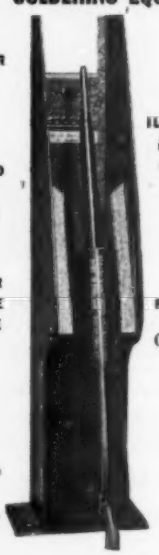
T. D. Keegan Ltd.
SOUTHEND AIRPORT
SOUTHEND-ON-SEA - - ESSEX

ADCOLA
(Regd. Trade Mark)
SOLDERING EQUIPMENT

THE ELECTRONIC INDUSTRIES SOLDERING TOOL FOR THE TRANSISTOR AGE

MANUFACTURED IN ALL VOLT RANGES

DESIGNED FOR CONTINUAL USE ON BENCHLINE ASSEMBLY



ILLUSTRATED ¼" Bit Model (Cat: No. 70)

PROTECTIVE SHIELD (Cat: No. 68)

British & Foreign Patents Reg. Designs etc.

Catalogues from Head Office, Sales & Service
ADCOLA PRODUCTS LTD.
GAUDEN ROAD, CLAPHAM HIGH STREET, LONDON, SW4
Telephones: MACaulay 3101 & 4272

CLASSIFIED ADVERTISEMENTS

PRESS DAY: Classified Advertisements must normally be received at Head Office by FIRST POST THURSDAY for the following Friday week's issue. Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

RATES—1/- per word (minimum 12 words 12/-). Each paragraph charged separately and name and address must be paid for. Semi-displayed setting £3-17-6 per single column inch. Centred lines 22/6. Series discounts of 5% for 13, 10% for 26 and 15% for 52 consecutive insertions, allowed to trade advertisers.

TERMS—Strictly net and prepayable. Monthly accounts for settlement by the end of the month following insertion are allowed to trade advertisers if satisfactory references are provided.

REMITTANCES—Cheques and postal orders should be crossed and made payable to TEMPLE PRESS LIMITED and instructions sent addressed to the Manager, "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

DEPOSIT SYSTEM—Facilities are available to readers to purchase advertised goods through "The Aeroplane and Astronautics." Commission 1% (minimum 2/-) on amount deposited.

BOX NUMBERS—Private advertisers desiring to have replies sent care of "The Aeroplane and Astronautics," may do so on payment of 1/- to cover booking and postage, plus cost of four extra words. Box Numbers must not be used for the purpose of circularizing and the Proprietors do not undertake the distribution of such matter received. To avoid mistakes in forwarding, Box Numbers should be carefully and legibly copied and replies sent to Box A000, care of "The Aeroplane and Astronautics," Bowling Green Lane, London, E.C.1.

THE PROPRIETORS retain the right to refuse or withdraw advertisements at their discretion and are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

HEAD OFFICES: Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus London Telex." Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50 Hertford Street, Coventry. Telephone: Coventry 27414. 1 Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12 Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AIRCRAFT FOR SALE

W. S. SHACKLETON LTD.

EUROPE'S LEADING AIRCRAFT BROKERS

MAKE

A STATEMENT

AS a considered policy our company has never accepted an agency, exclusive or otherwise, for any aeroplane or engine manufacturer whether British or foreign. On numerous occasions in the past, many of the World's foremost light aircraft builders have suggested, even begged us, to represent them in the United Kingdom and handle the exclusive sale of their products.

WE have always been appreciative of these offers and at times have been sorely tempted to accept. Nevertheless, we believe our policy is the right one because we are completely unbiased and free to recommend just the most suitable aircraft for any particular task.

THE price will be the same!

AS our recent sales week-end at Kidlington will have demonstrated, we are on the happiest terms with all the British manufacturers (we can supply anything from a D.H. Heron to an Auster or Rollason Turbulent), and with the distributors and factory representatives of the most popular American and European builders, Beech, Bellanca, Cessna, Champion Tri-traveller, Falco, Helio Courier, Omnipol, Piaggio, Piper, Tipsy Nipper.

FOR example, we have already sold five Piper Apaches, two new ones and three used ones. We were also responsible for the sale of several Cessnas and two Piaggio 166s, the last one to the Earl of Derby.

WE will take your present aeroplane in part-exchange, Hire-purchase and Insurance arranged. W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Phone, Hyde Park 2448-9. Cable, Shackhud, London. 540-14

ROLLASONS pay full P.P.L. course at club of your choice when you contract to buy a Jodel. For details of this and of the Turbulent and rebuilt Tiger Moths, phone Croydon 5151, or write Rollason Aircraft and Engines, Ltd., Croydon Airport. zzz-737

DC4E For sale or long lease, inspect Copenhagen. Astraeus Ltd., 167 Victoria St., S.W.1. Victoria 1403. 540-5

TIPSEY Trainer, with Bianchi Full-Vue canopy, special trimmer and seats, genuine 100 m.p.h. cruise; 150 yds. take-off and land; 3½ gals. per hr.; permit to fly March, 1961; approx. 500 total hrs. air frame, 100 engine (not raced); carefully maintained. A comfortable 2-seater, delightful to fly. £975 or best. J. O. Hodgson, "Velden," Carre St., Sleaford, Lincs. Phone 96. 541-9014

£2,500. The most exquisite of all de Havilland private aeroplanes. A perfect example of the D.H. Dragonfly. This delightful aeroplane has two Gipsy Major IF engines, five seats and dual control. Its flying qualities are perfect and it will maintain height honestly on one engine at full load. The cabin is more comfortable and as quiet as any of the Americans, and is fitted with heater, radio compass, V.H.F. and best of all 85 gal. of fuel. It has been completely rebuilt and will last at least another 10 years. Offered with new C. of A., and resprayed to customers' requirements. Hampshire Aeroplane Club, Southampton Airport, Eastleigh 3360. 540-8

EXECUTIVE

DE HAVILLAND DOVE.

TOTAL TIME, 1,146 HRS.

BOX A403,

Care of THE AEROPLANE AND ASTRONAUTICS. 540-11

FOUR D.H. Dove Mk. 1B, full airline standard, excellent condition, available immediately from £9,000. Channel Airways, Southend Airport, Essex. Phone, Rochford 56460. 540-20

W. S. SHACKLETON LTD

Europe's Leading Aircraft Brokers offer

VICKERS VISCOUNTS

Two of the three Vickers Viscount 700 Series aircraft which our company has just sold on behalf of Air France to Maitland Drewery Aviation Ltd. are pictured above at Cambridge Airport where they are now being maintained by Marshalls Flying Services Ltd.

Our experience in handling used Viscount aircraft is probably unsurpassed.

If you have a requirement for Vickers Viscounts, either to buy or to charter, we shall welcome the opportunity of being of service.

W. S. SHACKLETON LTD.
175, Piccadilly, London, W.1
Phone: HYDe Park 2448-9
Cable: Shackhud, London

META-SOKOL

THE FINEST VALUE IN THE WORLD TODAY

Attractive four-seat aircraft providing economical operation with comfort and safety. Ideal for private and business users.

- ★ **Range 650 miles at 127 m.p.h. with a fuel consumption of only 5 gallons per hour.**
- ★ **Modern design features include all-metal construction, retractable undercarriage, V.P. propeller and the latest 140 h.p. Walter M.332 engine with direct fuel injection.**
- ★ **24 hours spares service and full maintenance backing available in the U.K.**

THE AEROPLANE AND ASTRONAUTICS reports:

"With its comprehensive equipment, attractive specification and excellent performance, the Meta-Sokol appears to be an extremely worthwhile proposition."

Early Delivery. Demonstrations Arranged.

Sole U.K. distributor for OMNIPOL, Prague:

Group Captain EDWARD MOLE,
Aircraft & General Finance Corporation Ltd.,
3 Red Place, Green Street, London, W.1.
Tel.: Grosvenor 4360. Cables: EMAVIAT, London.

R. K. DUNDAS, LTD.,

AN UNBEATABLE SELECTION.

1959 SUPER CUSTOM TRIPACER, green and white, total time: airframe 990 hours, zero-houred engine s.m.o., complete overhaul of all instruments, Narco VHT-3 Superhomer, all optional extras included, immaculate throughout, new C. of A., duty paid, £3,895.

1957 SUPER CUSTOM TRIPACER, total time 875 hours airframe, zero-houred engine s.m.o., completely re-covered and overhauled airframe, including all instruments, Narco VHT-3 Superhomer, all optional extras included, really immaculate, new C. of A., duty paid, £3,270.

1951 CESSNA 170, all metal in beautiful overall condition, all primary instruments, Lear VHF, half life engine, currently available in U.K., £2,650 duty paid.

1959 AUTOFLITE COMANCHE 180, built July 1, total time, 185 hours, green and white, Mk. II Omnigator, L.F. Rec. ADF-12E, C. of A. duty paid, £7,695.

1959 AUTOFLITE COMANCHE 180, total time 290 hours, Mk. II Omnigator, L.F. Rec. ADF-12E. C. of A., duty paid, £7,265.

DUNDAS further proudly claim to have sold more used American flight aircraft than any other dealer, which is a direct reflection of our ability to supply:—

* THE Finest Aircraft,
* AT the lowest price.
* WITH experience-backed ability for service.

TAKE advantage of the first year's monetary depreciation by purchasing a used aircraft.

R. K. DUNDAS, LTD., Dundas House, 59 Saint James's St., London, S.W.1. Phone, Hyde Park 3717. Cables, "Dundas, Piccy, London." 540-16

PETER CLIFFORD AND CO.

MILES Hawk Major, airframe hours 2,263, engine hours 718, C. of A. expires 25.2.61, £550.

MILES Messenger IIA, airframe hours 828, engine hours 327, C. of A. expires 8.4.61, £1,550.

INQUIRIES invited for any type of aircraft or radio.

TRESA, Kirtlington, near Oxford. Phone, Kidlington 3355, Bletchington 392. 540-17

PBY 5A.

TWO AMPHIBIANS CONVERTED FOR TWO-CREW CARGO-PASSENGER USE.

BOX A404,

Care of THE AEROPLANE AND ASTRONAUTICS. 540-12

AVRO CADET 643, fitted Genet Major, 150 hours since complete C. of A., expires 1963, rebuilt and re-covered, two spare engines and airframes available, also Armstrong Whitworth V-8 engine circa 1917 with propeller, complete in maker's box. Box A4010, care of THE AEROPLANE AND ASTRONAUTICS. 540-x6674

HANTS AND SUSSEX AVIATION, The Airport, Portsmouth, offer the following aircraft for sale. AUSTER AIGLET, low hour engine, long C. of A., radio, night flying equipment, choice of two. RAPIDE aircraft as is, and rebuilt, choice of two.

AGRICULTURAL TIGER MOTHS, dusting and spraying equipment, low hour engines, 12 months C. of A., choice of three.

AVRO 19 Series 2, 12 months C. of A. nil hour engines, reconditioned throughout.

AIRSPEED CONSUL, choice of two aircraft, suitable for spares cannibalization, including low hour engines.

FULL details of above available from Hants and Sussex Aviation, Ltd., The Airport, Portsmouth. Phone, Portsmouth 62087. 540-9999

Aircraft Wanted

SCRAP aircraft aluminium and stainless steel urgently required. Lowton Metals, Ltd., Lowton St. Mary's, near Warrington. Leigh 1444-5. zzz-711

WANTED Light aircraft, 30-150 h.p., any condition, details to Box A406, care of THE AEROPLANE AND ASTRONAUTICS. 450-x6635

AIRCRAFT ACCESSORIES, SPARES AND COMPONENTS

THE REGIONAL AIR TRADING CO., Croydon Airport, for Rapide spares of every description. Phone, Croydon 8521. zzz-714

ROLLASONS for Tiger Moth spares and for Gipsy engine overhauls and spares. Croydon 5151. zzz-738

PHILLIPS AND WHITE, LTD.

THE leading stockists in the U.K. for: Instruments, navigational equipment, electrical components and parts, and engine accessories. Spares for de Havilland Gipsy Major and Queen series and Armstrong Siddeley Cheetah IX, X and XV engines.

61 QUEEN'S GARDENS, London, W.2. Phone, Ambassador 6651, 2764. Cables, "Gyrair London." zzz-748

REPAIRCRAFT, LTD., The Common, Cranleigh, Surrey (Cranleigh 536), for instrument and autopilot overhaul. zzz-749

AIRFRAME spares for Dakotas, Harvards, Piper Cub, Fairchilds, Argus, Beechcraft, D-17s, Mosquito, Spitfire, Firefly. Engine spares for Pratt & Whitney, Armstrong Siddeley, Lycoming, etc., accessories and instruments for all types of aircraft.

C.47 Dakota operators please note, we offer a limited number of genuine brand-new Bendix 52058 tail wheels at a reasonable price.

A. J. WALTER, LTD., The Drive, Horley, Surrey. Phone, Horley 1420 and 4284. Cables, "Cubeng, Horley." 540-18

Aircraft Accessories, Spares and Components Wanted

FUEL tank units, brake cables and undercarriage actuator for Gemini. Exeter Airport, Ltd., Airport, Exeter. Phone 67433. 540-9010

HELICOPTERS

HELICOPTERS SERVICES, LTD., offer their aircraft for all charter services. 96 Piccadilly, London, W.1. Gro 5495-6. zzz-74

CLOTHING

R.A.F. Officers' uniforms for sale, new and reconditioned. Fisher's, 86-88 Wellington St., Woolwich. Phone 1055. Kit also purchased. zzz-721

CONSULTANTS

R. H. STOCKEN, F.R.Ae.S, Eagle House, 109 Jermyn St., S.W.1. Whitehall 2777-9. zzz-743

IAN L. S. McNICOL, London School Air Navigation. Pilot and navigator training with advisory service. 33 Ovington Square, Knightsbridge, S.W.3. Ken 8821. zzz 746

R. W. SUTTON (CONSULTANTS), LTD., 7 Lansdown Place, Cheltenham. Phone 5811. 547-8985

HIRE AND CHARTER

RAPIDES for hire or charter. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0731

VICKERS Viscounts for charter. W. S. Shackleton, Ltd., 175 Piccadilly, London, W.1. 540-21

NOTICES

AIR TRANSPORT ADVISORY COUNCIL.

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM SILVER CITY AIRWAYS, LTD., OF 62 BROMPTON ROAD, LONDON, S.W.3:—

APPLICATION NO. 3566 for a Vehicle Ferry Service with Bristol 170 aircraft, for the carriage of vehicles and associated passengers, incidental passengers and supplementary freight, between Blackpool (Squires Gate) and the Isle of Man (Ronaldsway), at a frequency in accordance with traffic demand for seven years from the date of approval.

FROM DAN-AIR SERVICES, LTD., OF 36-38 NEW BROAD STREET, LONDON, E.C.2, for the following U.K. Internal Services with Dove, Dakota, Bristol 170 and Ambassador aircraft, for the carriage of passengers, supplementary freight and mail:—

APPLICATION NO. 3552 on the route Plymouth and/or Bristol and/or Liverpool-Newcastle, at a frequency of seven return flights weekly, for seven years from August 1, 1960.

APPLICATION NO. 3553 between London (Gatwick) and Jersey, at a frequency of four return flights weekly with Ambassador or Bristol 170 aircraft (or at an equivalent capacity with Dove or Dakota aircraft) from June 1 to September 30 each year, for seven years from 1961.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council should reach them within the period allowed for the making of representations or objections. 540-4

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143-9 Fenchurch St., E.C.3. Phone, Mansion House 3089. Official packers and shippers to the aircraft industry. zzz-674

Air Traffic Control Officers

for

MINISTRY OF AVIATION

Age 23 to 35. Good education and recent aircrew or air traffic control experience essential. Salaries: while training £775 to £1,130 according to age; when fully trained approximately £950 at age 25; £1,160 at age 30 or over rising to £1,480.

Promotion prospects.

Write Civil Service Commission, Burlington Gardens, London, W.1

for application form, quoting 5084/60.

VIGORS FOR PIPERS

KIDLINGTON 3059 — OXFORD

PIAGGIO *of GENOA*

5 popular P.166 Executives have been bought by British business flyers during the first year that it has been in production

British Representatives

AERO-ENTERPRISES

(Boreham Wood) Ltd.

17 Drayton Rd., Boreham Wood, Herts. ELS 2688

AUSTER AIRCRAFT LIMITED

require for their

FARNBOROUGH OFFICE

a fully qualified and experienced

STRESSMAN

to take charge of their stress office.

Also required

SENIOR & INTERMEDIATE STRESSMEN

Apply:

AUSTER AIRCRAFT LIMITED

ALEXANDRA ROAD, FARNBOROUGH, HANTS

Telephone: Farnborough, Hants 227

RADIO AND RADAR

SPERRY ZERO reader, Type ZL1 course selectors, control panels, flight computers and indicators, three complete installations in stock. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0729

STR12D, STR9Z, STR9X and most other British and American VHF R/T equipment always in stock. A.R.B.-approved design installations into any type of aircraft. A. J. Whittemore (Aeradio), Ltd., Biggin Hill Aerodrome, Kent. zzz-0730

RADAR height-finding cabins, type 13/6, practically complete. Offers required. Box A011, care of THE AEROPLANE AND ASTRONAUTICS. zzz-718

SITUATIONS VACANT

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms. Over 95% successes. For details of exams and courses in all branches of aeronautical work, aero engines, mechanical engineering, etc., write for 148-page handbook—free. B.I.E.T. (Dept. 703), 29 Wrights Lane, London, W.8. zzz-740

A-LICENSED radio engineer required from July 14 for 8-week period in Bermuda. This is not a permanent position. Persons with qualifications stated should communicate with Chief Engineer, Eagle Aircraft Services, Ltd., London Airport, Hounslow, Middx. 540-9003

EAGLE AIRWAYS (Bermuda), have the following immediate vacancies:—

A AND C Licensed Engineer Viscount Aircraft. Based Bermuda, £180-£187 per month.

A AND C Licensed Engineer Viscount Aircraft. Based Miami, $725 per month.

APPLY: Chief Engineer, Eagle Aircraft Services, Ltd., London Airport, Hounslow, Middx. 541-9007

AIR CONDOR, LTD., requires Captains and First Officers for Bristol and Viking aircraft. Please phone Avenue 9431. 540-9008

SECRETARY/SHORTHAND Typist required for interesting permanent position with London Aircraft Brokers; five-day week; commencing salary £550 per annum.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. 540-9009

AIR Traffic Control Officer required at Exeter Airport. Certificate of Competency and jet experience necessary. Commencing salary £1,135 per annum. Pension scheme. The Manager, Exeter Airport, Exeter. Phone 67433. 540-7

MINISTRY OF AVIATION requires Assistant Technical Cost Officers in London to prepare estimates of prime costs of manufacture of engineering productions. Duties normally involve a considerable amount of travelling. Qualifications: Recognized engineering apprenticeship or equivalent training in an appropriate trade. Good practical experience in rate-fixing, operational planning and prime cost estimating of engineering productions. Vacancies exist in various sections dealing with high-class mechanical and electrical productions—aircraft, instruments, electronic equipments or work which requires very good machine shop experience. Salary: £900 (age 30)-£1,065 p.a. Application forms from Manager (P.E.16), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon St., London, E.C.4. 540-3

AERONAUTICS, MECHANICAL ENGINEERING, OR EQUIVALENT QUALIFICATION REQUIRED.

ELECTRONICS ENGINEER.

(Senior or Intermediate.)

Flight Test application of telemetry and strain gauge experience preferred.

SENIOR SYSTEMS ENGINEER.

Flight development engineering and systems experience essential.

INSTRUMENTATION ENGINEERS.

Aircraft instrument development and calibration experience essential.

PLANNING ENGINEER

for planning aircraft aerodynamic and engineering flight requirements.

CRAFT AND TRADESMEN.

RADIO MECHANIC

with V.H.F. and U.H.F. servicing experience and aircraft control tower equipment maintenance.

AIRCRAFT ELECTRICIANS.

Experience of modern aircraft installations and systems essential.

These vacancies offer excellent conditions of employment with a progressive organization engaged upon a comprehensive programme of new project and development work. Excellent social and welfare facilities.

Applications to the

PERSONNEL MANAGER,

FOLLAND AIRCRAFT, LTD.,

HAMBLE, HANTS.

Phone, Hamble 3371. 540-6

PROJECT Engineers and a number of assistants are required by the research and development department, aerodynamics and design section, to undertake interesting and varied design development work on parachute systems for a range of requirements.

THE work will also involve attendance at, and analysis of, flight trials. The ideal candidate for the senior posts would have a degree in aeronautical engineering with some research experience in a branch of the aircraft industry or at a research establishment.

PENSION scheme in operation. Salary for a project engineer would not be less than £1,000 p.a.

APPLY, Personnel Officer, Irving Air Chute of Great Britain Ltd., Icknield Way, Letchworth, Herts. 541-9013

APPLICATIONS are invited from Aircraft Engineers holding licences in categories A and/or C for the de Havilland Dove and Heron. Vacancies are in the U.K. and overseas. Apply Contracts Division, British United Airways, National Works, Bath Rd., Hounslow, Middx. 541-9015

VIKING first officers required, BALPA rates. Apply in writing to Operations Manager, Continental Air Transport, Ltd., Southend Municipal Airport, Southend-on-Sea, Essex. 541-9012

A And C Licensed Engineer required to maintain Piper Apache based at Kano, Nigeria. Salary £1,050 p.a., plus bonus of 10s. per revenue flying hour, with free board and accommodation. Applicant must be of bachelor status. Apply in writing to British United Airways, Ltd., Redhill Aerodrome, Surrey. 541-9011

SOUTHERN AERO CLUB. Wanted: Full-time Instructor with cadet approval. Phone, 3430 Shoreham, Sussex. 540-13

STARWAYS of Liverpool, require Staff Pilots on DC3 and DC4 aircraft with guaranteed winter employment. Freelance or pilots on leave in July, August and September also invited to apply to Chief Pilot, Starways, Ltd., Liverpool Airport. 540-10

CHIEF INSPECTOR.

A LEADING machine tool maker in the Midlands invites applications for this important post.

APPLICANTS should preferably be not more than 45 years of age, with a professional qualification or equivalent and with practical knowledge of modern inspection methods.

THE person appointed will be directly responsible to the Works Director for the maintenance of a high standard of quality control.

THE salary will be commensurate with the importance of this key position.

APPLICATIONS, which should be as detailed as possible, should be sent marked "Private and Confidential" to BOX A401, care of THE AEROPLANE AND ASTRONAUTICS. 540-1

PERMANENT appointments open with Independent for experienced senior captain and first officer with licences for Viking and Viscount. Existing staff notified of this advertisement. Full details in strictest confidence to The Principal, Box A405, care of THE AEROPLANE AND ASTRONAUTICS. 542-9017

SILVER CITY AIRWAYS, LTD.,

INVITE applications from pilots with minimum qualifications Commercial Pilots licence, Instrument Rating, R/T licence and Performance A for operations based at Lydd. Apply in writing to Group Personnel Officer, 62 Brompton Rd., London, S.W.3. 542-9016

THE
SCIENTIFIC CIVIL SERVICE
NEEDS MEN AND WOMEN
FOR
PENSIONABLE POSTS AS
(a) SENIOR SCIENTIFIC OFFICERS
AND
(b) SCIENTIFIC OFFICERS
IN ALL MAJOR SCIENTIFIC FIELDS,
INCLUDING:—
PHYSICS,
ENGINEERING,
CHEMISTRY,
METEOROLOGY,
MATHEMATICS and
BIOLOGY.

Age limits: (a) at least 26 and under 32; (b) at least 21 and under 29. Extension for regular Forces service and Overseas Civil Service. Qualifications: normally first- or second-class honours degree in science, mathematics or engineering, or equivalent attainment; additionally for (a), at least three years' relevant (e.g. post-graduate) experience. Selection by interview. London salaries (men): (a) £1,233-£1,460; (b) £655-£1,150; provision for starting pay above minimum. Promotion prospects. Write

CIVIL SERVICE COMMISSION,
17 NORTH AUDLEY STREET,
LONDON, W.1,
for application form,
quoting (a) S/53/60; (b) S/52/60. 540-2

IRANIAN AIRWAYS CO., Teheran, require the following:—
1. Two A- and C-licensed engineers with Viscount coverage, salary scale U.S. $500.00 plus U.S. $200.00 per month living allowance, 2-year contract, base Teheran.
2. One A-licensed radio engineer familiar with Bendix, Marconi and Collins, salary scale U.S. $400.00 plus U.S. $200.00 per month living allowance, 2-year contract, base Teheran.
3. One A- and C-licensed engineer with Dove coverage, salary scale U.S. $500.00 plus £55 per month living allowance, 2-year contract, base Abadan.

APPLY Blandford and Houdret, Ltd., 101 Leadenhall St., London, E.C.3. Phone, Avenue 5115. 542-9019

ENGINEERS holding A and C licence on Dakota and Viking aircraft required. Also licensed and unlicensed radio engineers and X-licensed electricians. Apply Channel Airways, Southend Airport. Phone, Rochford 56460. 540-19

COMMERCIAL pilot Rapide, Auster for charter company in Eire. Skycraft Services, Ltd., 56 Lower Mount St., Dublin. 540-15

SITUATIONS WANTED

COMMERCIAL pilot offers services, temporary/permanent, home/overseas. Perf. A and I.R. soon 5,000 hours, 4,000 command singles, twins, fours, experienced crop spraying. Box A402, care of THE AEROPLANE AND ASTRONAUTICS. 540-9

PILOT, Q.F.I. A2, 2,600 hrs., approach and G.C.A. controller. Available September. Air or ground. Box A407, care of THE AEROPLANE AND ASTRONAUTICS. 540-x6501

Fly as an Officer in today's Royal Air Force

If you are young and fit, have a good education and can take responsibility, you may be accepted for training as a Pilot, Navigator, or Air Electronics Officer in the General Duties (Flying) Branch of the Royal Air Force. On 1st April, 1960, better terms of service, pay and pensions came into force.

Full Career—Methods of Entry

Cadet Entry Men aged 17½ to 19½, who hold G.C.E. (or equivalent) in English Language, Mathematics and three other subjects (two at 'A' level), can train at Cranwell for permanent commissions as pilots or navigators.
Special Entry Men aged 19½ to 22 (and therefore ineligible for cadet entry) may be awarded permanent commissions if they possess the same educational qualifications as above and show exceptional promise.
University Entry Graduates under 26 may enter on permanent commissions which carry an ante-date of seniority. University students may be pre-selected subject to graduation.

Limited Service—Methods of Entry

Direct Entry Men aged 17½ to 25 who hold G.C.E. (or equivalent) at 'O' level in English Language, Mathematics and three other subjects are offered service to the age of 38, qualifying for generous retired pay and a tax-free gratuity of at least £1,300, and may in due course be considered for service to the age of 55 (with limited promotion prospects) or for transfer to a full career.
Short Service Commissions A few 5-year short service commissions are available to outstanding men under 22 with high educational qualifications or to University graduates under 26. Short service officers may in due course be considered for longer service in the same way as Direct Entry.
Write for further details, stating age and educational qualifications and the method of entry in which you are interested, to Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (AP 719), Adastral House, London, W.C.1.

TODAY'S TOP JOB IS
The Royal Air Force

Save Weight
Increase Payload
Carry More Passengers
Install
MALLITE EGB2 FLOOR PANELS
in your DC3, Viking, Ambassador or Viscount 800/810 Aircraft
Full details of the ARB approved installation are available.
WILLIAM MALLINSON and Sons Ltd.
130 HACKNEY ROAD LONDON E.2.

NEW BALL & ROLLER BEARINGS
Over 5,000,000 in stock
in more than 5,000 types
BRITAIN'S LARGEST STOCKS
WRITE FOR STOCK LISTS
CLAUDE RYE BEARINGS
895-921, FULHAM RD., LONDON, S.W.6
Phone: RENOWN 6174 (EXT. 24) TELEX 23453

AIRWORK SERVICES TRAINING
PERTH
SCHOOL OF AVIATION
SCHOOL OF ENGINEERING
Ministry of Aviation
Approved courses for Private and Commercial Licences and Instrument Rating.
Aircraft Engineers Licence courses.
Residential and Recreational facilities.
Prospectus from
Airwork Services Limited,
Airwork House,
35 Piccadilly, London, W.1,
and Perth Aerodrome, Scotland.

BRITISH WIRE THREAD INSERTS

Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.
B.S.F.
Metric
B.S.P.
B.A.
Whitworth
Unified.

CROSS
MANUFACTURING CO. (1938) LTD.
COMBE DOWN, BATH, SOMERSET
Phone: COMBE DOWN 2355/8 Grams: 'CIRCLE' BATH

ENGINEER, licensed A, B and C, all modern types, including Viscount, requires senior position, preferably abroad. Reply Box A409, care of THE AEROPLANE AND ASTRONAUTICS. 540-x6675

TUITION

DENHAM LINK TRAINING CENTRE. £1 seven-day week. Denham 2161 and 3171. zzz-741

AVIGATION, LTD., provides full-time or postal tuition or a combination of these methods for M.o.A. pilot-navigator licences. Classroom instruction can be provided for A.R.B., General, certain specific types and performance schedule examinations. Link Training Dept. at Monarch 1364. For details apply Avigation, Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. Phone, Ealing 8949. zzz-0719

INDIVIDUAL coaching as proved under our methods is the key to success. All professional pilot-navigator qualifications. Ministry-approved COM/IR/PPL. Refreshers; type ratings; performance; Link; R/T; flying. Home-study (correspondence) excellent alternative. Officially appointed Forces courses scheme. London School Air Navigation, 33 Ovington Square, Knightsbridge, S.W.3. Ken 8221. zzz-745

EXETER AIRPORT, LTD., AND PLYMOUTH AIRPORT, LTD., offer the least expensive and most comprehensive flying training available today. Contract rates from £2 17s. 6d. per hour; Auster Tiger, £3 12s. 6d.; Chipmunk, £5 5s.; Messenger, £4 18s. 6d. Twin Conversion, £6 12s.; P.P.L. courses from £108 15s.; C.P.L. from £605; Instructor's course from £72 10s. Special attention to individual requirements. Full air traffic control, radio aid, VHF-DF and 24-hr. met. service. Grass or runways. Local accommodation from £3 10s.; airport, £5 15s. 6d. Exeter Airport, Ltd., Exeter 67433; Plymouth Airport, Ltd., Crownhill, Plymouth 72752. zzz-750

FLYING lessons, radio, D4 Link, navigation, ground instruction, private, instrument commercial training, single or twin-engined planes. Maitland Drewery, Biggin Hill Airport. Phone 2277. zzz-752

INSTRUMENT rating. The new July 1 procedures with VOR, D4 trainers. We are specialists, established 12 years. Phone, Knightsbridge 2089. Link Training Services, Ltd., 33 Ovington Square, London, S.W.3. 547-9018

Cessna
SOLE DISTRIBUTORS IN GREAT BRITAIN ARE
AIRWORK SERVICES
35 PICCADILLY W.1. REG 8494

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, commercial and private pilots' training, night flying every night; Austers and Chipmunks from £3 15s. No entrance fee or subscription. Municipal Airport, Southend-on-Sea, Essex. Phone, Rochford 56204. 540-747

CLUB NOTICES, ETC.

SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 2295. M.o.A.-approved course. Tiger and Hornet Moths, Chipmunk and Prentice. Contract rates. Route 705, one hour from Victoria. 540-0994

BOOKS AND PUBLICATIONS

THE "POWER AND SPEED" SERIES FOR BOYS. "Aircraft and Air Power," by F. G. Swanborough, of THE AEROPLANE AND ASTRONAUTICS, has been written for intelligent boys between the ages of 10 and 16. The author surveys modern military flying and includes chapters on combat aircraft, scientific aids and missiles. Other titles in this series are "Motorcars," "Locomotives" and "Ships and Shipbuilding." Illustrated, 112 pages, 10s. 6d. net from booksellers, or 11s. 3d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

STEEL SHELVING
6' high, 34" wide, 12" deep.
6 shelves as illustrated.
£3.15.0
IMMEDIATE FREE DELIVERY
★ Each Shelf will hold over 3 cwt.
★ Shelves adjustable every 2 ins.
★ Stove enamelled dark Green.
★ Other sizes made to order.
SEND FOR LIST.
ROCHDALE METAL PRODUCTS
Devon St. Works
Tel. Rochdale 40070/40078

CROSS
PERFECT PRECISION AIRCRAFT SPRING WASHERS
TO B.S. SPECIFICATION 2 SP.47
CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH. Tel.: Combe Down 2355/8

"THE AEROPLANE" PICTORIAL REVIEW (No. 3). Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. This is the third annual miscellany of illustrations to appear in THE AEROPLANE AND ASTRONAUTICS and covers highlights of aviation for the year ended autumn, 1958. Over 250 illustrations, 128 pages, 10s. 6d. net from booksellers, or 11s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"CAMERA IN THE SKY," by Charles Sims, with a preface by Air Chief Marshal Sir James Robb. For more than 30 years Charles Sims, chief photographer of THE AEROPLANE AND ASTRONAUTICS and one of Britain's best-known aerial photographers, has watched the amazing growth of British aviation from a ring-side seat. In this book he recalls with pen and camera, enlivened with anecdote, some of his many memories of those eventful days. Illustrated, 218 pages, 25s. net from booksellers, or 26s. 6d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

THE EXPLORATION OF SPACE (First Cheap Edition), by Arthur C. Clarke. Provides answers to the many questions the intelligent layman asks about the science of "astronautics." Over 375,000 copies sold in all editions. Illustrated, 212 pages, 8s. 6d. net from booksellers, or 9s. 5d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

PRINCIPLES OF HELICOPTER ENGINEERING, by Jacob Shapiro. This comprehensive review of the engineering principles governing the design and construction of helicopters provides a complete survey of present knowledge in the field. Illustrated, 448 pages, 55s. net from booksellers, or 56s. 9d. by post from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

"THE AEROPLANE" PICTORIAL REVIEW (No. 4). Compiled by the staff of THE AEROPLANE AND ASTRONAUTICS. In this fourth annual miscellany of the most interesting photographs to have appeared in the pages of THE AEROPLANE there are over 230 photographs grouped for ease of reference, in 12 sections. New features are a Farnborough Display section and an index providing a ready reference to all makes of aircraft and missiles illustrated. 128 pages, 12s. 6d. net from booksellers, or by post 13s. 7d. from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1. zzz

THE N.L.A.C. PRESENTS
NEW AND USED
AEROPLANES OF ALL MAKES
Maintenance Facilities
Personal Attention
CESSNA SPECIALISTS
WITH ASSOCIATES IN NEW YORK
See our Demonstration Model
NORTHERN LIGHT AIRCRAFT COMPANY
ASHTON-UNDER-LYNE - - - LANCS
Telephone: Ashton-under-Lyne 2895

INDEX TO ADVERTISERS

Name	Page
A	
Adcola Products, Ltd.	22
Aero-Enterprises (Boreham Wood), Ltd.	24
Airwork, Ltd.	25, 26
Auster Aircraft Ltd.	24
B	
Blackburn Aircraft, Ltd.	8
B.P. Aviation Services	16
Bristol Siddeley Engines, Ltd.	20
British Oxygen Aviation Services	12
C	
Canadair, Ltd.	5
Central Office of Information, R.A.F. Recruiting	25
Convair; a division of General Dynamics Corporation	2
Cross Manufacturing Co. (1938), Ltd.	25, 26
D	
Decca Radar, Ltd.	Inside Back Cover
De Havilland Aircraft Co., Ltd.	13
De Havilland Engine Co., Ltd.	1
De Havilland Propellers, Ltd.	17
Delaney Gallay, Ltd.	19
Dunlop Rubber Co., Ltd.	18
E	
English Electric Co., Ltd., The, (Aircraft Equipment Division)	14
Esso Aviation, Ltd.	10, 11
H	
Hawker Siddeley Aviation, Ltd.	Back Cover
Hunting Aircraft, Ltd.	21
K	
Keegan, T. D., Ltd.	22
L	
Lucas, Joseph (Gas Turbine Equipment), Ltd.	Front Cover
M	
Maitland Drewery Aviation, Ltd.	22
Mallinson, Wm., & Sons, Ltd.	25
Metachemical Processes Ltd.	22
Ministry of Aviation	24
Mole, Group Captain Edward	23
N	
Northern Light Aircraft Co., The	26
R	
Rochdale Metal Products	26
Rotax, Ltd.	3
Rye, Claude, Bearings	25
S	
Shackleton, W. S., Ltd.	23
Shell Aviation Services	Inside Front Cover
Smart & Brown (Electrical Division), Ltd.	6
Standard Telephones & Cables, Ltd.	7
T	
Triplex Safety Glass Co., Ltd.	15
V	
Vickers-Armstrongs (Aircraft), Ltd.	9
Vigors Aviation, Ltd.	24
Vokes Genspring, Ltd.	4
Z	
Zwicky, Ltd.	6

Printed in England and Published Weekly by the Proprietors, TEMPLE PRESS LIMITED, BOWLING GREEN LANE, LONDON, E.C.1.
Registered at the G.P.O. as a Newspaper. Second class postage paid at New York, N.Y.

AGENTS ABROAD—EUROPE—Messageries Dawson (S.A.), Paris; Messageries Hachette, et Cie, Paris; W. H. Smith & Son, Paris and Brussels. CANADA—Wm. Dawson Subscription Service Ltd., Toronto; Gordon & Gotch Ltd., Toronto. U.S.A.—Eastern News Co., 306 West 11th Street, New York, 14, N.Y. AFRICA—Central News Agency, Ltd., Cape Town; W. Dawson & Son (S.A.), Cape Town. ASIA—W. Thacker & Co., Ltd., P.O. 190 Bombay. AUSTRALIA and NEW ZEALAND—Gordon & Gotch (A'sia), Ltd.

GAP FREE RADAR COVERAGE IN EXCESS OF 120 MILES AT 40,000 FEET

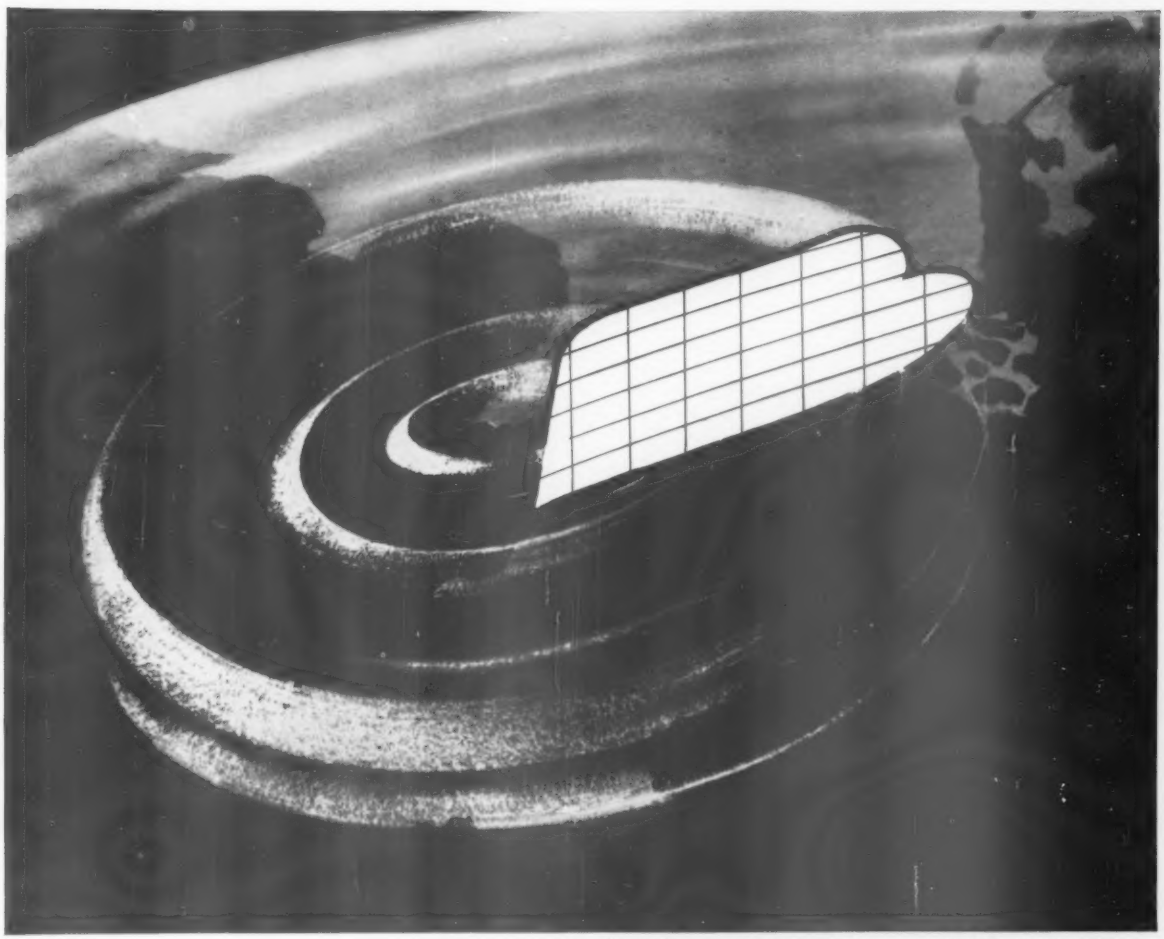


Illustration showing the gap free coverage a DASR-1 sited near London would provide.

DECCA DASR-1 civil surveillance radar

The Decca 10 cm DASR-1 is already in service yielding results which establish its supremacy as the ideal civil air surveillance radar for jet age operation.

Accurate, reliable information on all aircraft within the airspace probed by its powerful, gap free beams is assured. Immediate observation of aircraft as they enter the detection region or monitoring of aircraft immediately on take off are alike available to the controller.

- ✱ Provides high data rate and high discrimination resulting in positive, clear painting.
- ✱ Rain and snow returns are eliminated by the latest development of circular polarisation techniques, without impairing performance on aircraft.
- ✱ Excellent permanent echo suppression by the Decca A.T.I. system.
- ✱ Siting at Airports is straightforward as lobing at the frequency employed is not operationally significant.

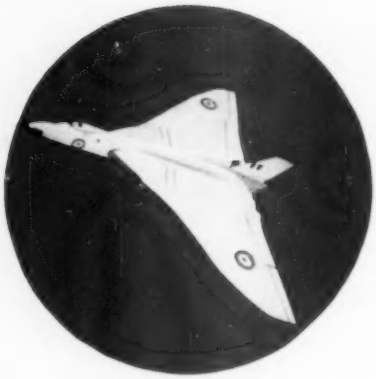
DECCA RADAR

DECCA RADAR LIMITED · LONDON · ENGLAND

DASR-1—radar for the jet age

DR128a

JUNE 24, 1960
Vol. 98. No. 2540



NO TIME OVER THE TARGET! No longer need bomber aircraft penetrate deeply into heavily defended areas. The Avro "Stand-off" bomb enables a target to be destroyed while the parent aircraft is returning to its base. V-bombers, armed with this air-launched weapon, are given new flexibility and striking power—greatly reinforcing Britain's deterrent strength. **HAWKER SIDDELEY AVIATION**
32 Duke Street, St. James's, London, S.W.1.